PROCEEDINGS

Fiftieth Annual Convention

OF THE

American Railway Bridge and Building Association

1943

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G. S. Crites
President, 1943

Proceedings of the

Fiftieth Annual Convention

OF THE

American Railway Bridge and Building Association

Held at

CHICAGO, ILLINOIS

October 20-21, 1943

Published by the Association
Elinor V. Heffern, Secretary
310 So. Michigan Ave., Chicago

CARL GORR PRINTING COMPANY
1801 W. BYRON ST. — CHICAGO

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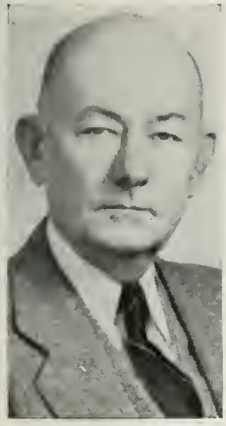

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SUBJECTS AND COMMITTEE PERSONNEL
1944 MEETING

(To be held at the Hotel Stevens, Chicago, October 17-19, 1944)

Post-War Values of War-Time Practices in Bridge, Building and Water Service Activities

E. H. Barnhart (chairman), div. engr., B. & O., Garrett, Ind.
R. E. Dove (vice-chairman), mg. ed., Railway Engineering and Maintenance Cyclopedia, Chicago
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G. L. Sitton, ch. engr. m. w. & s., Sou., Charlotte, N. C.
A. A. Sirel, engr. drafts., C. & N. W., Chicago.
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H. L. Veith, b. & b. supvr., Sou., Wilton, Ala.

Increasing the Capacity of Water Service Facilities to Meet Demands of Heavier Traffic

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A. P. Smith, fuel & water supvr., M. P., San Antonio, Tex.
W. A. Stewart, asst. supvr., b. & b., C. of Vt., Stafford Springs, Conn.
E. E. R. Tratman, civil engr., Wheaton, Ill.
M. P. Walden, asst. supvr., b. & b., L. & N., Evansville, Ind.

Keeping Work Equipment in Service

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J. L. Holmes, supvr., b. & b., N. Y. N. H. & H., New Haven, Conn.
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A. C. Jones, b. & b. supvr., Sou., Parish, Ala.
P. L. Koehler, div. engr., C. & O., Ashland, Ky.
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Dee Worlow, b. & b. fore., M. P., Kansas City, Mo.

New Possibilities in Building Designs and Materials

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J. S. Vreeland, assoc. ed., Railway Engineering & Maintenance, Chicago.
L. C. Winkelhaus, arch. engr., C. & N. W., Chicago.

Bridge Inspection in the Light of Current Restricted Maintenance

H. M. Barlow (chairman), asst gen. supvr., b. & b., C. & O., Richmond, Va.
R. W. Cook (vice-chairman), gen. insp., S. A. L., Norfolk, Va.
W. L. Baker, br. insp., C. & E. I., Salem, Ill.
J. E. Cooper, asst. b. & b. supvr., S. P., Oakland, Cal.
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W. A. Hutcheson, supvr., b. & b., C. & O., Clifton Forge, Va.
B. M. Whitehouse, gen. br. insp., C. & N. W., Chicago.

The Year's Developments in Labor

George E. Boyd (chairman), assoc. ed., Railway Engineering and Maintenance, Chicago.
G. H. Holmes (vice-chairman), supvr., b. & b., M. P., Falls City, Nebr.
R. C. Baker, b. & b. supvr., C. & E. I., Danville, Ill.
J. P. Canty, asst. to engr. m. of w. B. & M. Boston, Mass.
M. D. Carothers, ch. engr., Alton, Chicago.
G. S. Crites, div. engr., B. & O., Baltimore, Md.
L. D. Garis, asst. gen. br. insp., C. & N. W., Chicago.
J. S. Hancock, br. engr., D. T. & I., Dearborn, Mich.
A. B. Hillman, engr., m. of w., Belt Ry. of Chicago—C. & W. I., Chicago.
J. S. Huntoon, asst. engr., br., Mich. Cent., Detroit, Mich.
H. W. Jenkins, b. & b., supvr., N. Y. N. H. & H., Boston, Mass.
D. T. Rintoul, gen. br. insp., S. P., San Francisco, Cal.
T. H. Strate, div. engr., C. M. St. P. & P., Chicago.
H. A. Wistrich, asst. ch. engr., const. & m., Lehigh Valley, Bethlehem, Pa.

Recent Developments in the Treatment of Timber to Increase Its Fire Resistance

J. F. Seiler (chairman), prin. engr., service bureau, American Wood Preservers' Association, Chicago.
O. W. Stephens (vice-chairman), asst. engr., str., D. & H., Albany, N. Y.
H. M. Church, gen. supvr., b. & b., C. & O., Richmond, Va.
M. H. Dick, eastern ed., Railway Engineering and Maintenance, New York.
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H. W. Hauersley, ch. drafts., C. M. St. P. & P., Chicago.
F. W. Hillman, asst. engr., m., C. & N. W., Chicago.
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J. W. Martin, fire & tunnel insp., S. P., Sacramento, Cal.
P. F. McNally, asst. b. & b. supvr., S. P., Salt Lake City, Utah.
L. R. Morgan, fire prev. engr., N. Y. C., Detroit, Mich.

Welding in Bridge, Building and Water Service Work

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Lem Adams (vice-chairman), vice-pres., Oxwe'd Railroad Service Company, Chicago.
L. M. Firehammer (vice-chairman), gen. supvr., Ill. Ter., Springfield, Ill.
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F. G. Campbell, asst. ch. engr., E. J. & E., Joliet, Ill.
A. B. Chapman, br. engr., C. M. St. P. & P., Chicago.
Leland Clapper, ch. engr., D. M. & I., Duluth, Minn.
A. R. Harris, asst. engr., br., C. & N. W., Chicago.
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H. C. Larsen, str. iron fore., C. St. P. M. & O., St. Paul, Minn.
W. K. Manning, supvr., br., Erie, Cleveland, Ohio.
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F. R. Spofford, supvr., b. & b., B. & M., Boston, Mass.
I. F. Sterns, const. engr., Chicago.
A. A. Visintainer, asst. engr., Erie, Cleveland, Ohio.
T. M. Von Sprecken, engr., br., Sou., Cincinnati, Ohio.

PROCEEDINGS

MINUTES AND ADDRESSES

OPENING SESSION

Wednesday, Oct. 20, 1943

For the convenience of those using this volume, it is divided into two parts, one beginning with this page, presenting a running report of the annual meeting, with suitable page references to the second part, which groups together the committee reports and various technical papers and addresses.

The Fiftieth annual meeting of the American Railway Bridge and Building Association was called to order in the Crystal room of Hotel Sherman, Chicago, at 9:55 a. m., Wednesday, October 20, 1943. President G. S. Crites, division engineer, Baltimore & Ohio, presiding.

President Crites: This War-time conference of the American Railway Bridge and Building Association will come to order.

It is inspiring to see such a goodly number of members here. No deliberations of the moment should be undertaken without Divine guidance. Shall we rise and bow our heads while the Reverend C. A. Bloomquist, district superintendent of the Chicago Southern District of the Methodist Church, Chicago, invokes the blessings of God upon this conference. (Reverend Bloomquist delivered the invocation).

President Crites: Thank you, Reverend Bloomquist.

In these days of desperate shortages in almost everything that we as maintenance officers need, it is increasingly important that we put first things first and utilize the materials and the labor we are able to secure in those projects that are most important to our railroads. This requires rare discrimination. It is, however, of basic importance to us today. It is fitting therefore that we open our convention with consideration of what is necessary and essential to us as maintenance officers in war time.

H. R. Clarke, who will speak to us on this subject, is chief engineer of the Burlington lines. In this capacity, he, of necessity, faces this problem constantly and is, therefore, eminently qualified to talk to us covering it. Mr. Clarke is also president of the American Railway

Engineering Association, an organization to which we of the American Railway Bridge and Building Association look with respect and admiration. Its accomplishments through the years have made the railroads, in no small measure, what they are today. Mr. Clarke is keenly appreciative of the opportunities for constructive collaboration through association work, as is evidenced by his elevation to the position which he now holds in the A.R.E.A. He has long been a friend of our organization and has extended courtesies to us on many occasions. It is indeed an honor at this time to present Mr. Clarke, who will address you on "Maintenance Essentials in War Time."

Maintenance Essentials in War Time

By H. R. Clarke

Chief Engineer, Chicago, Burlington & Quincy, Chicago; Chairman, Engineering Division, Association of American Railroads; President American Railway Engineering Association.

H. R. Clarke

In a war-time conference such as this, we must eliminate all frills and get down to brass tacks. A glance at the program prepared for this meeting shows very quickly that this has been planned by the committee which prepared the program. Certainly, there is need for associations such as this and the one I represent, and certainly the need of the closest co-operation between these various associations is realized by all of us.

I think today, however, that I would rather be here with you, not as president of the American Railway Engineering Association, but rather as a railway maintenance officer, who from his own experience knows the problems that confront all of us in these days, who realizes the need that all have for such help as we can obtain from any source, and who believes that a meeting such as this is one way of obtaining that much-needed help.

Maintenance essentials in war time are exactly the same as they have always been and always will be; that is, to maintain railroad structures, signals and track to standards established, in the most economical way, and by the most efficient methods. At the present time, this is more difficult to do and the results of failures are more disastrous.

As the job is more difficult, the challenge is greater. Under ordinary conditions, if the railroads failed, if that form of transportation broke down, some other means would be available; another form could be used. At the present time, that would be impossible.

Railroads Must Do Job Alone

Today, if the railroads fail, transportation breaks down. In peace time, that would be unpleasant and uncomfortable; now, in war time, it would be disastrous. You know what it would mean to the nation and to the world. You know—yes, but I wonder if it is known generally; if people at large grasp the tragic possibilities. I fear it is not—that they do not know.

Not long ago a man of near cabinet rank, addressing leaders in industry, labor and the press, said:

"Civilians are partners in the war, and none more than the men who make the weapons with which our soldiers fight."

Very true, but what good would tanks, guns, planes or munitions be, stranded anywhere between the Atlantic and the Pacific? They are needed in Australia, Alaska, India, Russia—everywhere else but where made. Unless transported from where made to where needed, they are worse than useless, and moving them is the railroads' job. No other method or means will move them, and yet the railroads are seldom mentioned. Industries proudly fly their "E" pennants and their employees wear badges or buttons, which they have every right to do. Why not the railroads? I do not know the answer— I doubt if anyone does. Our reward, at least at present, must be that most satisfying one—the knowledge that a hard job has been well done.

Since these notes were prepared, a communication, which I should like to read, has been received from two officers of cabinet rank. It comes from Honorable Robert P. Patterson, Undersecretary of War, and Honorable James Forrestal, Undersecretary of the Navy, and is as follows:

"The War and Navy departments would appreciate your expressing to the men and women who work on America's railroads the gratitude of the Army and Navy for the splendid job they are doing. Since the outbreak of the war, the railroads have hauled 76,000,000 carloads of freight, most of it destined for battle fronts. Millions of fighting men have been transported to training camps and embarkation points.

"To the men and women who have made this record movement of men and weapons possible, the Army and Navy are deeply grateful. Keep up the good work, for railroad work is war work. Railroad service is vital to victory."

I think we will all agree that this tribute has been well earned.

Why is the job difficult? The answer is easy. The railroads are handling the heaviest traffic, both passenger and freight, they have ever handled in history, doing it under the greatest pressure, and there is a serious lack of men, materials, and machines needed with which to do the job as it should be done.

The answer to the next question —why does this condition exist? —is also easy. It is due to war-time demands and conditions.

What Can We Do?

The third and most important question is what can we do about it? This is not so easy to answer. In fact, a full and complete answer has not as yet been found. You will note I did not say, what can Congress, the national administration, the War Production Board, the Office of Defense Transportation, or even railroad management do about it? I said **we.** To help answer this question is why we are here today and tomorrow. I am not going to try to answer it—I know I cannot. I am expecting help from this conference, and hope some answers, at least partial, may come from the meeting of minds in this two-day session.

We can all think of many things others might do, such as draft deferment for railroad men; possible ways and means by which employment might be made more attractive, and so enable the railroads to compete with other industry for labor on a more equitable basis; recognition of the railroads as a war industry, and treatment accordingly in supplying

needed material and equipment; and many others. I fear, however, that if we wait for and depend on these, the consequences will not be to our liking. There may, and probably will, be a tragic and disastrous failure before corrective action is taken. So it comes back to us. We must do the job under existing conditions, using what we have.

The three things wherein the most serious shortage exists—men, machines and materials — are so interrelated that we can hardly think, much less talk, of one as separate and distinct from the other. Insufficient labor could be offset, to some extent at least, by the use of machines and work equipment, if they could be secured, and a lack of materials could be made up for partially by an increase in labor, and to some degree the reverse of that is true, but when none of the essentials is available in the amount needed, the problem becomes one which demands the best any and all of us have to give.

I shall not attempt to discuss all that we can and must do. That is the purpose of this meeting, and I am sure it will be well done. I shall merely touch on what seem to me to be the outstanding points.

First, material — steel, copper, wood—nearly everything we use, is scarce and classed as critical, and must be used to the best advantage. This means there must be no waste of any kind—the prompt picking up and shipping of any unused material, new or usable secondhand, to some other job, or to the storehouse where it can be sent out to some place where it is needed. All requisitions for tools, or for materials and supplies of any kind, should be checked carefully and no excess ordered. If you ask for, and by any chance receive, too much someone else will be short and his work handicapped.

Plans should be made well in advance of starting a project, and the stores department given advice as to the materials needed. This is most essential as it is not possible to maintain the liberal stores stock once carried, and such a stock should not be carried under present conditions. Ingenuity and initiative in finding ways to use what we have, instead of what we might like to have, will pay large dividends.

When speaking of materials, it will do no harm to mention the importance of promptly releasing cars used for company material. The way in which shippers in general are complying with this important rule is a large factor in making possible the successful job the railroads are now doing. If we do not make an even better showing, censure cannot be too severe.

It is fortunate that when manpower became scarce on the railroads, they were fairly well supplied with power tools and work equipment. It has been and is still practically impossible to secure additional units, so again it is up to us to make the most of what we have. Every piece of equipment should be used intensively. Many times it can be double-shifted at least, and so twice the output secured. The condition of all machines should be checked closely and frequently, and repairs made as needed to avoid breakdowns of long duration.

Here again, plans should be made in advance, and the work scheduled so that equipment can be kept busy and, so far as possible, furnished

for all work where its use will save labor. Equipment not in use and not needed immediately should be reported, and so made available for use where it is needed. To be selfish under present conditions, to hoard material or machines, to say nothing of men, is unpatriotic and disloyal.

Difficult as the situation is with regard to machines and material, the manpower situation is even more difficult and critical. The demands are far in excess of the supply, and a new factor, the human element, not involved in material or machines, must be taken into account. Many things have been done to add to available manpower. The minimum age limit has been lowered and the maximum raised, retired employees have returned to active service, physical standards have been modified and, in some cases, examinations have been waived. In addition, other measures of qualification for various positions have been lowered. All of this places on foremen and supervisors a responsibility greater than ever before. The work must be done with the help of men less experienced, less capable and less efficient than we have had in the past, and the factor of safety cannot be decreased. This task calls for the highest and best type of supervision and leadership that the men and officers of a department long noted for excelling in this respect, can give.

It is certain that we cannot do all the work we would like to do or that needs to be done. It is equally certain that we cannot fail in our responsibility to maintain the tracks and structures in safe condition to carry the traffic of a nation at war. To insure that we do not fail, each employee and officer who has any supervisory responsibility whatever, must know his job thoroughly. He must be intimately familiar with the property for which he is responsible, in order that he can make sure that the most important and urgent work is being done, and that such work as must be postponed, can be deferred safely.

Manufacturers Can Help

I have not been asked to address the manufacturers and supply men, but their assistance is needed now much more than when the job was not so difficult. If I may venture a suggestion, I would say that the greatest help they can be to us, the railroads and the country, is to give us as promptly as they can, full and accurate information in regard to the delivery of material, equipment, etc. If it is impossible to make good on a promised delivery, the sooner we know that the better. We can then, perhaps, modify our plans and adjust our forces to meet the changed conditions. If it becomes necessary for a manufacturer to offer some substitute, that information should be given us so we can act on it. Delay in giving such information makes our job more difficult. Surely, we will learn of it in time, and those manufacturers whose representatives are prompt to help us in such way as they can will be in better standing than those who seem to consider such advice a military secret.

To date the railroads have done a great job well. It has been done by the co-operation of all concerned —shippers, the railroad supply industry, all railroad employees from presidents down; and the Association of American Railroads and the

Office of Defense Transportation should not be forgotten. Perhaps the real test is yet ahead. I think it is; but if we are all determined to do our job and to help the other fellow to do his, we need have no fear as to what the final result will be.

President Crites: Mr Clarke, we know you are a very busy man, and our association is deeply appreciative of the time you have taken to bring us this message. On behalf of the association, I thank you.

Mr. Clarke: It has been a great pleasure, I assure you.

President Crites' Address

This is a war-time conference of our association. We are here to do everything within our power to bring this war to a quick and satisfactory conclusion for ourselves and our allies.

With this uppermost in our minds, it was clearly recognized that a convention was not in order. The conventions we have had in the past took three full days and were interspersed with entertainment and diversions which would ill fit war-time conditions.

We are meeting in this two-day conference because of the awareness on the part of your officers that while members of the association have been accomplishing almost impossible tasks, these have been accomplished often only with confusion and discouragement, due to the overwhelming necessity, in the face of many difficulties, for keeping our structures in condition for the most exacting service ever demanded of them.

Bridge and building men have made a remarkable record to date. They have kept bridge structures of all kinds in service, with few or no slow orders, under more, faster and heavier traffic than ever before. They have done this with small labor forces in most places and with no abundance of material at any place. They have kept turntables going 'round and round,' enginehouses tight, pipe lines together, ash and inspection pits safe, coal dumpers working, grain elevators functioning, fire protection intact, and all other structures performing their war-time duties as expected of them.

This has not been done by wishful thinking or by elaborate planning for the future. Rather, it has been accomplished by doing each day what has been necessary. At times, bridge and building men may offer a silent prayer for the morrow, but regardless of what the morrow may bring, they are always ready and continue to do first things first.

The investigations carried on by our committees and incorporated in the reports to be presented at this meeting are unusually timely, and should be of invaluable assistance to our members, as well as to bridge and building men generally, in meeting the difficult tasks that confront them. Besides this feature, there is always a sense of fellowship and common bond of responsibility that prevails at a meeting such as this.

At times, some of our members

may think they are the 'forgotten men' because so much of their work is hidden or taken for granted. The following instances will indicate why you may feel that way.

Have Many Duties

A track scale at a key point, such as on a hump or other location where cars have to be weighed before they can be classified and put in trains for movement, may fail. Bridge and building men must correct the condition immediately or there will be costly delays to important traffic. There is little glamour attached to going into a scale pit and correcting faulty conditions under stress. Probably there will be little acclaim for a job of this kind, even when done quickly and under very trying circumstances. Therefore, bridge and building men should hear from one another just how their trying tasks have been and can be accomplished.

It is sometimes found that a water column, through inept or inexperienced handling, is pulled out by its roots or broken off at a point where engines are hosteled. Delays in traffic would be the result of such a condition, if immediate replacements were not made. The water service forces assume the responsibility for getting this water column back in service in the shortest time possible, and also recognize that they must improvise means to get water into tenders while the column is out of service. These men do this work ingeniously and willingly, knowing that it must be done to further our war effort. But, even though the work is done willingly and efficiently, there is apt to be a feeling that the destruction of the water column should have been avoided; that they are just the 'goat' in such cases. Hearing how other water service men attack such problems helps a lot.

As true Americans, we know that our forces over-seas must have not only the best personnel possible, but that they must also be supplied with the best and most up-to-date fighting equipment available. We have watched many of our younger and more adventurous companions join the armed services to do their bit over-seas and have also seen some of their other young and active associates leave railroad employment to work in munitions plants or other war industries, where they feel they can take a more important part toward bringing the present conflict to a quick and successful conclusion. The remaining forces willingly take up the added load.

There probably has been no time in railroad history when bridge and building men have felt that they have had just the right amount and kind of materials, tools and labor to fill their needs in the best and quickest manner. War has made this situation still more acute. Now, it is absolutely essential that we resort to substitution and improvising. However, from our past training, and judging from accomplishments to date, we will continue to do well in this regard. To hear of the means developed by other members or other bridge and building men in solving these problems will fill us with encouragement and a new sense of determination.

Locomotives will not operate without fuel and will slip on the rails at times if the rails are not sanded. A failure of either a coaling or a sanding plant may cause a catastrophe to the exacting sched-

ule under which our trains are now being operated. Again, however, there is no glamour attached to the bridge and building personnel which at any time of day or night must exert every effort to see that our locomotives are supplied with fuel and sand at the right time. It is encouraging to all who may have anything to do with the operation and maintenance of such plants to hear how other members, or how other bridge and building men, meet such emergencies, and more particularly, how they keep such plants from failing.

The shortage of manpower, which is now acute, makes it more necessary than ever that the bridge and building forces secure maximum utilization of work equipment. This is a very live subject, and I am sure that everyone present will go away from this conference with a clearer view of the urgency of this need after hearing the excellent report of the committee which has investigated this subject.

With traffic rolling in volume never before attained and on more exacting schedules, and under the dire necessity of getting fighting men and war materials to the points needed as quickly as possible, bridge and building men recognize that the way in which they handle their work must not interfere with the movement of traffic. We look forward to learning how interference with traffic is being eliminated on roads other than our own, and it would seem that this subject alone may justify this wartime conference.

Another exacting problem that confronts us is that of making our present bridges and trestles not only stand up under the loads and speeds for which they were designed, but also carry the additional loads that are being imposed on them at greater speeds. This is indeed a problem under the present shortage of materials and labor, but we are pleased to report that it has been solved, and will continue to be solved. I am sure that the report and discussion we are to have on this subject will be well worth the two days we spend here.

Versatility, initiative and resourcefulness have enabled bridge and building men to meet their responsibilities to date and to keep free of failures the many structures under their care. This has not been an easy task. Their accomplishments during the last year or more have not been achieved without sweat and brain-wrecking conniving. However, these men were never nurtured in soft cribs; rather, they luxuriate in hard bunks.

Future No Feather Bed

As I see it, the immediate future will afford no feather bed for our members. We have done well to date, but there is still much for us to do. Victory is still the all-important goal. All else is unimportant by comparison, and it is to that end that we are all working.

With victory gained, what of the future? I believe we can be sure of this—with tasks well done behind us; with jobs that call for latent reserve out of the way; with that improvised at times found as good or better than that improvised for; and with wits sharpened and a knowledge that we have done what may have seemed impossible —we can look to the future with confidence and with cheer. Our association can also face the future with confidence.

The 1942 Proceedings are in the

hands of members. The contents are timely and inspiring.

This two-day conference, while staged as a war-time conference, takes on more of the tone of a "Get-Together for Victory." We are sure of victory, and we look forward with pleasure and anticipation to the time, that we hope will come soon, when your officers may consider having conventions to which we can again bring our wives, can assemble around our favorite tables with less critical burdens, and can recall these trying times with satisfaction. With this thought, we will continue with the program.

Committee Appointments

President Crites: The next order of business is the appointment of Special committees.

Nominations: A. E. Bechtelheimer, chairman; C. Miles Burpee, C. R. Knowles, T. H. Strate and Elmer T. Howson.

Subjects: J. L. Varker, chairman; Elmer T. Howson, L. C. Winkelhaus, C. Miles Burpee and A. M. Knowles.

Auditing: T. H. Strate, chairman; C. R.Knowles, R. E. Dove.

Resolutions: Neal D. Howard, chairman; L. C. Winkelhaus and R. E. Dove.

Convention City: C. R. Knowles, chairman; F. G. Campbell, J. L. Varker and Neal D. Howard.

Obituary: A. E. Bechtelheimer, chairman; F. E. Weise, C. R. Knowles and J. S. Vreeland.

President Crites: We will now take up the work of our committees, and will begin with the report of the Committee on Revising Working Practices to Eliminate Interference with Traffic. L. R. Lamport, assistant to chief engineer, C.&N.W., Chicago, is chairman of this committee.

. . . Mr. Lamport then read the report. (For report and discussion, see page 109.

President Crites: Our next report for consideration is on Securing Maximum Utilization of Work Equipment, which has been prepared by a committee of which D. T. Rintoul, general bridge inspector, Southern Pacific, is chairman. Owing to the almost impossible tasks that are being thrown on the men of the Southern Pacific at this time as a result of the war, Mr. Rintoul could not be present at this meeting. Therefore, John S. Vreeland, associate editor, Railway Engineering and Maintenance, has consented to present the report.

. . . Mr. Vreeland then read the report . . . (For report and discussion, see page 117.

President Crites: The next report we have to consider is on Carrying Over Bridges and Trestles, prepared by a committee of which H. T. Livingston, bridge engineer of the Chicago, Rock Island and Pacific is chairman. Mr. Livingston could not be here today and he has arranged for S. T. Corey, office engineer of his road, to present the report. We will be pleased if Mr. Corey will present the report.

. . . Mr. Corey then read the committee report . . . (For report and discussion, see page 124.

President Crites: It is now time to adjourn for lunch.

. . . Recessed at 12:30 p.m

Afternoon Session

Wednesday, October 20, 1943

The meeting was called to order at 2:20 p. m., President Crites presiding. The first part of the meeting was devoted to an address on Manpower for Railroad Bridge and Building by Edwin M. Fitch, assistant director of the Division of Transport Personnel of the Office of Defense Transportation. Elmer T. Howson introduced Mr. Fitch to the members. (For Mr. Howson's introduction, Mr. Fitch's address, and the discussion following, see page 29.)

President Crites: Our next order of business will be the hearing of an address on What Bridge and Building Officers Can Do with High School Boys which will be presented by W. G. Powrie, engineer maintenance of way, C.M.St.P.&P., . . . Mr. Powrie presented his address (See page 40).

President Crites: In connection with this labor problem, L. E. Peyser, principal assistant architect of the Southern Pacific, San Francisco, Cal., and a director of our association, has sent me a statement concerning the employment of part-time and week-end workers on the Southern Pacific Lines. Mr. Peyser was unable to be with us, so I will read his statement. (See page 48.)

President Crites: We will now hear from M. Young, Jr., supervisor of track on the Pennsylvania at Warsaw, Ind., who will address us on What Bridge and Building Officers Can Do with the Employment of Women. (For Mr. Young's address, see page 44).

President Crites: Before starting our discussion, we will hear one more committee report, covering another phase of this labor problem, entitled Men—How to Secure and Hold. M. D. Carothers, chief engineer of the Alton, Chicago, is chairman of this committee, but was unable to be with us today. Neal D. Howard, managing editor of Railway Engineering and Maintenance, and vice-chairman of the committee, will present this report. . . . Mr. Howard presented the report. (See page 50 for this report and page 57 for the over-all discussion of the report and addresses presented at this session).

President Crites: We will now stand adjourned until our Evening session at 7:30 p. m.

. . . Recessed at 5:40 p.m.

Evening Session

The meeting was called to order at 8:00 p. m., President Crites presiding. The program included an address by Lt. Col. Robert A. Radford, chief, engineering branch, Railway division, Office of Chief of Transportation, United States Army, Washington, D. C., and the showing of the technicolor film entitled "To Each Other," just completed by the United States Steel Corporation.

Morning Session

Thursday, October 21, 1943

The meeting was called to order at 9:45 a.m., President Crites presiding.

President Crites: The first order of business for this morning's session is a report of the Committee on Materials—Possibilities of Relief Through Substitutes. This committee is headed by W. A. Sweet, general foreman of bridges and buildings on the A.T.&S.F., at Newton, Kan. In view of Mr. Sweet's inability to attend our wartime conference, the report will be read by C. Miles Burpee, managing editor, Ry. Eng. & Mtce. Cyclopedia.

. . . Mr. Burpee read the report. (See page 67).

President Crites: I will ask Elmer T. Howson to present our next speaker, A. C. Mann, vice-president of the Illinois Central System, who will address us on the general subject of materials. (For Mr. Howson's introduction, Mr. Mann's address and the discussion that followed, see page 73).

President Crites: We will now hear a paper prepared by A. M. Knowles, engineer of structures of the Erie, on What Bridge and Building Officers Can Do to Help in Bridge Materials. In the absence of Mr. Knowles, R. E. Dove, our immediate past-president, will read the paper.

. . . Mr. Dove then presented the paper. . . (See page 79).

President Crites: At this time we will hear A. L. Sparks, architect of

the Missouri-Kansas-Texas Lines, and past-chairman of the Committee on Buildings of the American Railway Engineering Association, on What Bridge and Building Officers Can Do to Help with Respect to Materials. Mr. Sparks.

. . . Mr. Sparks then addressed the meeting. . . (See page 82).

President Crites: Warren C. Kendall, chairman of the Car Service Division of the Association of American Railroads, will now address us on Our Responsibility as Railroad Officers in Meeting the Nation's Demands for Cars.

(For President Crites' introduction of Mr. Kendall, Mr. Kendall's address and the discussion following, see page 93).

President Crites: This completes our program for this morning; we will now interrupt our session for luncheon, which will be tendered to us by the Bridge and Building Supply Men's Association. We will continue our program at 2:00 p.m.

. . . Recessed at 11:50 a.m.

Afternoon Session

Thursday, October 21, 1943

The final session of the meeting was called to order at 2:16 p.m. President Crites presiding.

President Crites: We will continue our program by hearing a paper on What We Can Expect in Water Service Materials. E. M. Grime, engineer of water service of the Northern Pacific, has prepared a statement on this subject. In his inability to be with us today, this paper will be presented by H. W. Sudlidge, chief chemist for the Northern Pacific.

. . . Mr. Sudlidge read the paper. (See page 85).

President Crites: O. F. Dalstrom, senior structural engineer, Division of Civilian Supply, War Production Board, has transmitted to us a paper entitled, What We Have Discovered. Past-President A. E. Bechtelheimer, engineer of Bridges, C. &N.W., will read this paper to us.

. . . Mr. Bechtelheimer presented the paper. (See page 88)

President Crites: Next on our program is a committee report on Salvaging Bridge, Building and Water Service Materials. The committee handling the subject was headed by H. W. Wuerth, division engineer of the C. M. St. P. & P., at Savanna, Ill. W. A. Huckstep, general supervisor, Missouri Pacific, at St. Louis, Mo., will present the report.

. . . Mr. Huckstep presented the report. (See page 133).

President Crites: At this time we will hear a report of our Committee on the Maintenance of Coaling and Sanding Plants to Meet Today's Exacting Requirements. A. L. McCloy, chairman of the committee, and supervisor of Bridges of the Pere Marquette at Saginaw, Mich., will present the report.

. . . Mr. McCloy presented the report. (See page 139).

President Crites: As has been the custom for a few years now, we will have a review of the highlights of the annual meeting. R. E. Dove our immediate past-president, and

assistant engineer of the Chicago, Milwaukee, St. Paul and Pacific Railroad, will present these highlights. Mr. Dove.

President Crites: A year ago when I took this gavel, I said: "It is an inspiration to look back at our meetings and recall some of the strong and able men who have held this gavel. Among them are Messrs. Montzheimer, Hadwen, Weise, Knowles, Howson, Strate, Burpee, Chinn, Bechtelheimer, Church and Dove."

This recalls to me that 39 years ago, A. Montzheimer was in the same position I have held for the last year. It is wonderful to think of this and to know that Mr. Montzheimer is here now. If he will come up, I will surrender the gavel to him.

A. Montzheimer (retired): It is a great pleasure to be up here and to meet so many of my friends. This has been an excellent meeting. Thank you.

President Crites: This completes the presentation of committee reports, addresses, and discussions for this our War-Time Conference —the fiftieth annual meeting of the American Railway Bridge and Building Association.

Business Session

President Crites: We will now go into the business session of the association. The first order of business is the secretary's report. While we are waiting for the secretary to come in, I will read the treasurer's report as it has been turned over to me by the treasurer.

Treasurer's Report

Cash Balance—September 30, 1942			$ 104.13
Receipts			
Dues	$1,643.10		
Advertising:			
Advanced $160			
Accts. Rec. 595	755.00		
Miscellaneous	37.30		2,435.40
			2,539.53
DISBURSEMENTS			
Salaries	608.38		
Stat. & Printing	327.21		
Office Rental, Tel. & Sten. Exp.	147.96		
Convention Expense—1942	238.75		
Social Security Tax	9.74		
Proceedings	1,132.80		
Miscellaneous	228.19		2,693.03
DEFICIT—September 30, 1943			$ 153.50

Signed—F. E. WEISE, Treasurer

President Crites: It has been regularly moved and seconded that the treasurer's report be placed on file.—The motion was carried.

President Crites: We will now hear the secretary's report.

Secretary's Report

Active Membership, September 30, 1942		502	
New Members added during year		40	
	Total	542	
Died	10		
Resigned	16		
Dropped	11	37	
	Total		505
Associate Members—September 30, 1942	16		
Died	1		
Added	1		
Associate Members—September 30, 1943			16
Total Active and Associate Members			521
Life members 48			
Retired members 27			75
			596
1 Honorary Member			1
Total membership—September 30, 1943			597
Total membership—September 30, 1942			618
Loss during year			*21

* These 21 members were erroneously carried in active list. Failure to contact these members through successive mailings determined move to strike them from the membership list.

Signed—ELINOR V. HEFFERN—Secretary

President Crites: You have heard the reading of the secretary's report. If there are no omissions or corrections, it will stand approved as read.

The next order of business will be the presentation of the Auditing committee's report.

Auditing Committee

Gentlemen:

We, the undersigned members of the Auditing committee, have examined the books of the secretary and treasurer and find them correct as of September 30, 1943 in so far as records are available at this time. Due to the delay in the printing of the Proceedings, it will be necessary to make further audit when all bills and receipts are available.

This will be so handled and further report made to the association at that time.

Signed:

T. H. Strate, Chairman
C. R. Knowles
R. E. Dove.

Subjects Committee

President Crites: The next order of business will be the presentation of the report of the Subjects com-

mittee. Mr. Varker, will you as chairman present the report of this committee.

Mr. Varker: Your Committee on Subjects recommends that the following subjects be assigned to committees for study and report at our annual meeting in 1944:

1—Post-War Values of War-Time Practices in Bridge, Building and Water Service Activities.

2—Increasing the Capacity of Water Service Facilities to Meet Demands of Heavier Traffic.

3—Keeping Work Equipment in Service. (Including: (a)—The Selection and Training of Operators to Avoid Undue Wear and Tear of Equipment, (b)—The Maintenance and Repair of Equipment.)

4—New Possibilities in Building Designs and Materials.

5—Bridge Inspection in the Light of Current Restricted Maintenance.

6—The Year's Developments in Labor.

7—Recent Developments in the Treatment of Timber to Increase its Fire Resistance.

8—Welding in Bridge, Building and Water Service Work.

Signed:

J. L. Varker, Chairman
Elmer T. Howson
L. C. Winkelhaus
C. M. Burpee

President Crites: It has been regularly moved and seconded that the subjects selected by the Subjects committee be accepted. The motion carried.

Resolutions Committee

R. E. Dove (C.M.St.P.&P.): Mr. President, I move that when the Resolutions committee report is prepared that it be made a part of the minutes of this meeting and included in the Prodeedings of this War-Time Conference.

President Crites: You have heard the motion. The motion was regularly seconded and carried.

RESOLUTIONS

The members of the American Railway Bridge and Building Association are loyally behind the war effort of the country. With a deep sense of responsibility, they have toiled unceasingly, often at the expense of their health and well being, to maintain those facilities of the railways—bridges, buildings, and water service facilities—given to their charge, without which the railways could not have achieved their remarkable record of war transportation to date, nor could long meet the heavy demands of the days ahead. Likewise, our association, as such, representing the combined interests and efforts of bridge and building men, is loyally behind the war effort of the country, accepting its responsibility as never before. The very fact that it has met here during the last two days in war-time conference, is in itself, further evidence of this desire on the part of the association to contribute further to the war effort.

Having decided upon a meeting this year, grave responsibility fell upon your officers and directors to make the program of that meeting of maximum benefit to members individually, and to bridge, building

and water service men generally over the country. They accepted that challenge, and, as a result of their efforts, we are now consummating one of the most intensive most timely and most helpful meetings in the long history of this association. To make this possible, your officers enlisted the co-operation of many persons, men who have contributed generously of their time and ability. It is proper and fitting, therefore, that we, as an association, express our sincere appreciation to all collectively, and especially to those who have contributed most largely, in one way or another, to the success of this meeting.

Be it resolved, therefore, that we express our appreciation to the following individuals, committees and others for their efforts and co-operation through the year just passed:

To those railway executives and other railway officers who have shown a keen interest in the work of our association, and who have made it possible for so many to attend this meeting.

To the Rev. Churley A. Bloomquist, district superintendent of the Chicago Southern district of the Methodist Church, for his invocation at our opening session.

To H. R. Clarke, chief engineer of the Chicago, Burlington & Quincy, and president of the American Railway Engineering Association, Chicago, for his timely and informative message at our opening session.

To Edwin M. Fitch, assistant director, Division of Transport Personnel, Office of Defense Transportation, Washington, D. C.; Lt. Col. Robert A. Radford, chief, Engineering branch, Railway Division, Office of Chief Transportation, U. S. Army, Washington, D. C.; Albert C. Mann, vice-president, Purchases and Stores, Illinois Central, Chicago; O. F. Dalstrom, senior structural engineer, Division of Civilian Supply, War Production Board, Washington, D. C.; Warren C. Kendall, chairman, Car Service Division, Association of American Railroads, Washington, D. C.; W. G. Powrie, engineer maintenance of way, Chicago, Milwaukee, St. Paul & Pacific, Chicago; L. E. Peyser, principal assistant architect, Southern Pacific, San Francisco, Cal.; Malcolm Young, track supervisor, Pennsylvania, Warsaw, Ind.; A. M. Knowles, engineer of structures, Erie, Cleveland, Ohio; A. L. Sparks, architect, Missouri-Kansas-Texas Lines, St. Louis, Mo.; and E. M. Grime, engineer water service, Northern Pacific, St. Paul, Minn., for their timely and constructive addresses or papers on a wide range of vital subjects.

To past-president R. E. Dove, assistant engineer, Chicago, Milwaukee, St. Paul & Pacific, Chicago, for his able address summarizing and highlighting the activities of our meeting during its closing minutes.

To the Bridge and Building Supply Men's Association for the pleasant, informal luncheon tendered to our members on the second day of our meeting.

To Railway Engineering and Maintenance, and to its publisher, the Simmons-Boardman Publishing Corporation, for pre-printing our reports, and for making available copies for use by members during our meeting; and—

To the officers and directors of our association, and to the chairmen of its committees, for the time

and effort they have expended on the affairs and work of the association during the last year.

Signed:
N. D. Howard, Chairman
L. C. Winkelhaus
R. E. Dove

Obituary Committee

President Crites: The next order of business will be report of the Obituary committee. C. R. Knowles substituted in reading the report for the chairman, A. E. Bechtelheimer.

Gentlemen:

It is with profound sorrow and regret that we record the passing of ten of our members since our last meeting. Their names are:

E. H. Dresser	Oct. 15, 1943
Thomas H. Durfee	Dec. 27, 1942
A. E. Gephart	Dec. 16, 1942
Floyd Ingram	Dec. 15, 1943
George Loughnane	Jan. 23, 1943
L. R. McAllister	June 6, 1943
E. C. Morrison	Nov. 9, 1942
Jesse B. Teaford	Nov. 9, 1942
Clifford E. Ward	Sept. 29, 1943
Charles F. Weir	Oct. 15, 1943

Among the foregoing, you may recall, Mr. Ingram was a charter member of this association, joining in 1891. He was elected to life membership in 1922.

This association suffers a great loss in the passing of these our honored members. Therefore, be it resolved that our heartfelt sympathy goes out to their loved ones in their bereavement, and that this resolution expressing our sympathy be spread upon the minutes of this meeting, and that a copy be sent to the families of our deceased members.

A. E. Bechtelheimer, Chairman
C. R. Knowles
J. S. Vreeland
F. E. Weise

President Crites: It has been regularly moved and seconded that the report of the Obituary Committee be accepted. The motion carried.

Report of Convention City Committee

President Crites: We will now hear the recommendation of the committee on choice of convention city. Mr. Knowle, will you submit the report?

C. R. Knowles: Your committee has given careful consideration to the selection of a meeting place for 1944. Because of the war-time conditions under which we are now laboring, we have no alternative than to recommend that the 1944 meeting be held in the city of Chicago.

Signed:
C. R. Knowles, Chairman
F. G. Campbell
J. L. Varker
N. D. Howard

President Crites: It has been regularly moved and seconded that the report of the Convention City Committee be accepted as read. The motion carried.

Election of Officers

President Crites: The next order of business will be the report of the Nominating committee. Mr. Bechtelheimer, will you, as chairman, present your committee's recommendations.

A. E. Bechtelheimer: Mr. President, war conditions interjected considerable difficulty in the deliberations of the Nominating committee. However, we have completed a fine slate of officers. Our report is as follows:

For:

President, J. L. Varker, D. & H.

First Vice-President, R. E. Caudle, M. P.

Second Vice-President, N. D. Howard, Ry. Eng. & Mtce.

Third Vice-President, F. G. Campbell, E. J. & E.

Fourth Vice-President, J. S. Hancock, D. T. & I.

Secretary, Elinor V. Heffern

Treasurer, F. E. Weise, Treasurer Emeritus, C. M. St. P. & P. (retired).

Directors:

Term Expiring 1944, to fill vacancies:

A. L. McCloy, Pere Marquette

W. F. Martens, A. T. & S. F.

Term Expiring 1945:

E. H. Barnhart, B. & O.

L. E. Peyser, S. P.

A. B. Chapman, C. M. St. P. & P.

Signed:

A. E. Bechtelheimer
C. Miles Burpee
C. R. Knowles
T. E. Strate
E. T. Howson

President Crites: Gentlemen, you have heard the report of the Nominating committee. Any member has the privilege of suggesting further names for officers of the association from the floor. Hearing none, what is your pleasure?

W. A. Huckstep (M.P.): I move that the recommendations of the Nominating committee be accepted, that nominations be closed, and that the secretary be instructed to cast a unanimous ballot in favor of the nominations as submitted. The motion was regularly seconded and carried.

Secretary Heffern: Mr. President, I cast the ballot in favor of the officers and directors recommended by the Nominating committee.

Installation of Officers

President Crites: We will now consider any New Business to come before the association.

Hearing none, the next order of business will be the installation of officers. Before that takes place, I would like to say that when I accepted the presidency of this association a year ago, I remarked that I did not expect ever to have a greater honor bestowed upon me. I still have that thought. My work for the association in the past year has had the primary objective of what we could do best to help win this war. If Republics are to last, associations like ours must work. Every member must work, not only for his railroad and his association, but also for his family, his church, his lodge, his club and all other institutions that make our way of life the best in the world.

I will now surrender the gavel to our incoming president, J. L. Varker. Mr. Varker, with a great deal of confidence and in anticipation of a very successful year for you, I hereby surrender to you the gavel of the American Railway Bridge and Building Association.

President-Elect Varker: Thank you, Mr. Crites.

Members of the American Railway Bridge and Building Association:

Things are certainly happening fast these days. This morning when I came to the meeting, I had no idea that I would be chosen as your president. Now that I am here, I know that I will need a lot of help. It is my intention to do whatever I can for the association.

President Crites: I would like to suggest that Past-President Bechtelheimer conduct the induction of officers.

Mr. Bechtelheimer: Let me congratulate you, Mr. Crites. You have done a fine job.

Before I say anything to you, Mr. Varker, I would like to ask the other newly-elected officers present to come to the platform.

Mr. Varker, yours is an enviable position. You have been given a great responsibility. However, you have demonstrated already that you are equal to it. I congratulate you and wish you the greatest of success.

President Varker: Thank you.

Mr. Bechtelhemier: Mr. Howard, you are more or less familiar with your duties. They are many, but I know you will meet them. I congratulate you.

Mr. Howard: Thank you.

Mr. Bechtelheimer: Mr. Campbell, you are a man of much experience in other associations. The American Railway Bridge and Building Association is well aware of your ability to assume responsibility and to handle it properly. I congratulate you.

Mr. Campbell: Thank you.

Mr. Bechtelheimer: Mr. Knowles, the old war horse, has returned. It is indeed fitting that you should take over the duties of treasurer, now that Fred Weise feels he must lay down this part of the work of the association. While it is a source of regret to him to give up his duties as treasurer, I know he will take great pleasure in knowing that his work has been put in your hands. Congratulations.

Mr. Knowles: Thank you.

Mr. Bechtelheimer: Mr. McCloy, you have probably attended as many association meetings as any member. Am I right?

Mr. McCloy: Yes, I believe you are.

Mr. Bechtelheimer: While you are, therefore, familiar with the work of the association, as a director you will come in still closer contact with this organization. I think you will enjoy it. Congratulations.

Mr. McCloy: Thank you.

Mr. Bechtelheimer: Miss Heffern, in the last nine months I think you have demonstrated to everyone who has had any contact with the association, that you have its best interests at heart. You have done splendid work and I know you will continue to do so. I congratulate you.

Secretary Heffern: Thank you.

President Varker: Is there any further business to come before the meeting?

If there is no further business to come before the meeting, we will close this War-Time Conference, and Fiftieth Annual Meeting of the American Railway Bridge and Building Association, adjourning to one year hence.

. . . Meeting adjourned at 4:30 p.m.

A Bird's-Eye View of The Railroad Manpower Situation

By Edwin M. Fitch

Assistant Director, Division of Transport Personnel, Office of Defense Transportation, Washington, D. C.

(Introduced by Past-President Elmer T. Howson)

E. M. Fitch

Elmer T. Howson: The program this afternoon will be one of the high points of this war-time conference. It will deal with the No. 1 problem of the railways. I doubt whether there is a man in this room who has all the labor he needs to carry out the program before him. I doubt if he has all the labor he needs to put in even the depleted amount of material he has or will be able to secure. Labor is the acute problem, and it is not going to get better. Those who purport to be prophets are warning that it is not going to get better for some time.

Appropriately, when the Office of Defense Transportation was organized, it set up as one of the major branches of that organization the Division of Transport Personnel. And they did this in anticipation of the inroads that the war would make on the labor forces of the railways. They put in charge of this division men who are keen students of the labor problem.

A year ago, Edwin M. Fitch came before us to present an interesting, practical talk, and brought us much information about the situation nation-wide. Individually, we know what the situation may be on our respective roads, but we are not so well informed on what that condition is or may be on other roads. Across Mr. Fitch's desk and that of his associate superior officer, Otto Beyer, flow constantly reports on the labor problems of the railways, and he is going to bring the composite picture from these reports to us as a prelude to more specific statements from individual roads. He is going to tell us the problem as it is seen nation-wide. Then we will hear from three other men on what specific roads are doing to solve their labor problem, and will then have our committee report on How to Recruit and Hold Men, which will be followed by a discussion which we hope will contribute still further to the solution of this problem.

I am not going to introduce Mr. Fitch to you because he is known to you. Most of you were here last year and were greatly interested in, and enlightened by, his address. Therefore, I am merely going to present Mr. Fitch, assistant director of the Division of Transport Personnel of the Office of Defense Transportation. It is a compliment to our organization that he would leave his busy desk to be here. Mr. Fitch.

Address by Mr. Fitch

Before attempting to dip seriously into the subject on which you have asked me to speak, I would like to say that I appreciate the compliment of a return engagement. I shall not attempt to go over again the ground I tried to cover last year. Much of what I said then still holds. Instead, I shall try to review the manpower developments of the last year as they have affected railroad employees, and particularly bridge and building department employees, and give you as much indication as I can of what may be expected in the future. My bird's-eye view of the manpower situation in railroading will necessarily be as from the top of the Washington Monument, rather than from the top of a railroad water tank. In that respect, it must be balanced by your day to day experience in order to represent an accurate picture.

An outstanding development of the last year has been a progressive deterioration in the manpower situation as far as ability to recruit is concerned. That the manpower problem is the Number One problem of war industries, and of war-essential industries generally, is repeated now far more often and with much greater emphasis than it was a year ago. In spite of that, you in the bridge and building and water service departments of the railways have held your own. In June, 1941, there were 39,700 employees in your department; in June, 1942, 42,800 employees; and in June, 1943, 43,100. The July comparison is less favorable, since it showed a seasonal gain last year which was not quite equalled this year.

If the statistics tell a true story, you have done particularly well in skilled occupations. The most important of these, of course, is bridge and building carpenters. In this category, the employment gain this year over last has amounted to about 1,400 workers. The increase amounts to 10 per cent of your present carpenter force. You have also increased the number of employees among painters, masons, bricklayers, plasterers and plumbers, portable steam equipment operators, and pumping equipment operators.

Labor Situation Deteriorating

The real story of the difficulties encountered during the last year is revealed by the statistics of helper, apprentice and laborer occupations. In such occupations employment has fallen off much more sharply than is good for the bridge and building department. In terms of number of employees, maintenance of way and structure helpers and apprentices have fallen off nearly 15 per cent, and maintenance of way laborers, other than trackmen, 18 per cent. Again, if the statistics tell a true story, it is these less skilled, less well-paid occupations, that have presented your most serious manpower problem during the past year, and which will present an even more serious problem during the coming year.

Since I addressed your meeting last year, the Railroad Retirement Board has inaugurated a system of reporting expected gross hires in the railroad industry by month and by occupation. These reports show labor needs rather than labor

shortages, so that they represent the number of men you would like to hire rather than the number of men you are short. Even so, they indicate a deteriorating manpower situation. Estimated gross hires for the current month in the bridge and building department totaled 1,140 in February, 1943, 2,754 in August, and 3,485 in September. Needs for maintenance of way and structures helpers and apprentices increased from 615 in February, 1943 to 1,520 in September, and for laborers, from 140 in February, 1943 to 499 in September. In these Retirement Board reports, the need for bridge and building carpenters has likewise shown an increase from 300 in February, 1943 to 1,193 in September. During this same period there have been a few lay-offs, but the number has been so small as to be insignificant.

On the assumption that the man-hour productivity of employees has not decreased, you have gained a substantial addition to your working force during the last year through increases in average hours worked. Even in 1942, the men in your department were working 50 per week or more on the average, a substantially greater average hours than in almost any other department of the railroads and far greater than in most war production plants. This average increased between June, 1942 and June, 1943 to 53 hours per week. On the basis of the hours in effect in June, 1942, this represents the equivalent of adding 2,800 workers to the payrolls. With a total employment of some 43,000, this has meant a very considerable addition to your working force in terms of man-hours. It is highly doubtful whether it would be wise to attempt any further increase in hours worked, though there are some occupations, such as bridge and building painters, where hours are below the average for all bridge and building workers.

I mentioned previously the Railroad Retirement Board monthly reports on gross hires during the current month. That these figures should not be used as a measure of labor shortage is indicated by the number of hires which the railroads have made. In terms of new workers alone, the railroads of the country are actually hiring many more individuals per month than they report to the Railroad Retirement Board in terms of expected gross hires per month. I know that the figure will startle you, but statistics of new accounts of the Railroad Retirement Board—that is, individuals with earnings reported by various railroad companies, who had not worked in the railroad industry prior to 1937—shows that during the twelve months ended June 30, 1942 the railroads were able to hire 1,040,000 such new workers. This figure is so large as to seem impossible, yet the totals are taken from reports of individual railroad companies to the Railroad Retirement Board and represent the establishment of rights under the Railroad Retirement Act. It is hardly conceivable that they could be in error in any significant respect. It is, of course, true that a large but unknown number of these new hires represent employees taken in for short periods for emergency work. Even so, it is highly significant of the success of the recruiting efforts of the railroads and the Retirement Board that so many new workers have been secured.

Turnover Problem

When the labor needs of the railroad industry are compared with new hires, it is perfectly obvious that the Number One manpower problem of railroads, as for many other American industries, is the problem of turnover. If turnover can be reduced, even by rather small percentages on the average, and the present rate of new hires continued, there should be little labor shortage in the railroad industry, except in the most critical areas of the country.

A compendium of letters from workers in a recent issue of the Reader's Digest indicates the major reasons for their dissatisfaction with their jobs. Almost every one of these letters indicate that the worker's major difficulty was because of his foreman. I think that it is quite generally recognized that the foreman is the key to any program of reducing turnover. There are, of course, many reasons for worker transfers with which the foreman has nothing to do and over which he has little control. At the same time, a foreman who intelligently appreciates and sympathizes with the work problems of his gang, and who knows how to be firm and decent at the same time, can go a long way toward counteracting the motives which lead employees to quit.

There is a widespread impression that differentials in wage rates are the primary cause of turnover. If this is true, why is it then that some of the worst turnover problems are being experienced in the high-wage plants? Granted that everything possible should be done to solve wage difficulties; granted, too, that the present wage situation, particularly for the non-operating groups with which you are concerned, constitutes a major railroad headache; even so, turnover can be reduced substantially if somebody takes the responsibility for instituting a program to reduce it and follows through on such a program.

I would like to suggest that the training agencies of the War Manpower Commission be called in for help. The carrying out of practical, down-to-earth plans for foremen training constitutes a major contribution of the Training-Within-In-Industry division. Foremanship courses are also available through public vocational schools. There are field representatives of War Manpower Commission training agencies in key cities throughout the country. Your division officers should get in touch with them and see what can be done toward instituting short courses for the training of your foremen.

It must be granted that the depression period constituted very bad training for many foremen in the railroad industry, as in many industries. It was hardly necessary during a very long period for foremen to worry at all whether men were satisfied or dissatisfied with their jobs. For every one that quit, there were ten men to take his place. It is almost inevitable that some of your foremen should carry over into the present period some of the attitudes they acquired during times of widespread unemployment.

Recognition of the problem of turnover has placed a great deal of emphasis upon the importance of exit interviews. I realize that the railroads have not had personnel departments which would lead naturally to the installation of such

devices as this. Nevertheless, I think it is perfectly possible for division officers to place on certain of their supervisory officers the responsibility for conducting an exit interview with every man who gives notice of his intention of quitting. This will save men to your departments, and it may also put the spotlight on some employment conditions which, if altered, will reduce the reasons for quitting.

My third suggestion has to do with housing conditions. A recent issue of Collier's contained a rather terrifying article on housing, living and recreation facilities in war-boom towns. The railroads must serve those towns and some of your bridge and building men have their headquarters there. Most of the bad housing conditions are, of course, associated with the large influx of new workers into war plants. There have been, however, reports from all over the country of housing situations which have affected railroad workers, and which, in some localities, have made it exceedingly difficult to keep men on the job. After all, the wage situation does not give railroad employing officers a very good chance to argue about the merits of railroad employment in terms of differential wage rates. All the more reason why every incentive to remain in railroad employment, not connected with wage rates, should be stressed. Railroad officers, therefore, should keep in close touch with housing conditions which lead workers to become dissatisfied with their jobs. The Federal Public Housing Authority is ready to help. I have recently seen a long list of the accomplishments of this agency in terms of alleviating bad housing conditions which were affecting railroad workers.

I am going to say more in a moment about the railroad manpower program issued recently by the Office of Defense Transportation. A recommendation that railroads appoint an officer to assume responsibility for investigating housing conditions affecting railroad workers is one of the points in that program. It is not an item which railroad officials in the past have found necessary to think about nearly as much as it is necessary to think about it now. I remember that I stressed this point in my remarks to you last year. It is even more important now than it was then.

Replacement Schedules

Generally speaking, the railroads have fared well at the hands of local Selective Service boards. At the same time, the last year has seen some developments that were not good for your industry. Every time a railroad wage case goes through the processes of the Railway Labor Act, quite a number of people, usually outside the railroad industry, have a lot to say about "featherbed" rules. It happens that way during the last year. An article in the Reader's Digest copied from Barron's Weekly was very widely read and commented upon throughout the country. It was an inaccurate article with respect to some of its facts, and it was grossly in error with respect to some of its emphasis. Many local Selective Service board members read that article and came to the conclusion that the railroads did not deserve the manpower protection of occupational deferments.

The Office of Defense Transportation did its best to counteract

some of this unfortunate publicity. Director Eastman testified before the House Military Affairs Committee on the so-called "featherbed" rules, and a pamphlet based upon that testimony was issued widely to government officials and to other individuals interested in the railroad manpower problem. We hope these measures had some counteracting effect, but in many quarters it was rather tough going.

We finally came to the conclusion that the proper way for the railroads to solve their Selective Service problem was by joining in with the Replacement Schedule program of the Selective Service System. According to that program, an opportunity is given to the State Directors of Selective Service, through information furnished by the railroads, to judge their manpower problems in relation to Selective Service as a whole. It has been too easy for any individual Selective Service board member to say, "One or two more railroad men inducted into the Army will have no effect on the general railroad situation — and anyway, what about the 'featherbed rules'?"

The Replacement Schedule procedure gives State Selective Service officials an opportunity to look at the manpower problems of a given division of a railroad and to make a much more intelligent decision as to the number of men who should be drawn into military service. Its net result is a kind of agreement between railroad officers and Selective Service officials as to which men will be called to military service and which will remain on occupational deferment, and for how long. Once such a schedule is submitted and approved by the State Selective Service director having jurisdiction, Forms 42-A are filed for the individuals for whom occupational deferment is indicated by the road's replacement schedule, and Selective Service is then in a position to give a fairly good guarantee that these requests for deferment will be honored.

The preparation of Replacement Schedules by railroads was another of the recommendations made by the Office of Defense Transportation in the recently issued manpower program. I hope you will lend your co-operation to these efforts. While they will not solve, they will at least ameliorate the railroads' Selective Service problem.

Critical Occupations

Another Selective Service development during the last year has been the issuance of a list of 149 occupations declared to be critical on the national basis. The issuance of this list by no means supersedes the previous lists of essential occupations issued by the War Manpower Commission and its Bureau of Selective Service. It does mean, however, that the individuals in such occupations are being given and will be given a greater amount of Selective Service protection than is true of the essential occupations not included in the critical list. There are a fair number of railroad occupations in this list, but, except for foremen and professional staff, there are few which are applicable to the bridge and building department.

These critical occupations have a double significance. Not only will individuals in such occupations be entitled to greater Selective Service protection, but they will also

be subject to more stringent hiring controls established by the War Manpower Commission. In the case of the railroads, these controls are largely exercised by the Employment Service of the Railroad Retirement Board, acting in this respect as an agent of the WMC.

The drafting of pre-Pearl Harbor fathers is also, of course, a new development during the last year. Few have yet been inducted into military service and it is my hope that Selective Service will call pre-Pearl Harbor fathers from less essential industries before they are called from more essential industries like the railroads. In this connection, State directors are telling companies who are preparing Replacement Schedules—and this includes the railroads—to put pre-Pearl Harbor fathers in the list of employees to be deferred for at least six months. Occupational deferments cannot be granted for more than six months, although they are, of course, subject to renewal. This deferment constitutes a very important additional reason why the railroads should follow the Replacement Schedule program. It provides a mechanism whereby the induction of pre-Pearl Harbor fathers in the railroad industry can be deferred at least until such fathers in less essential industries are called. Unless the armed forces must expand greatly their requirement for men over present estimates, there is at least a good possibility that inductions of such fathers in the railroad industry can be postponed for a long time to come.

Stabilization Plans

Another development during the last year, of considerable importance to the railroads, is the extension to them of the stabilization plans of the War Manpower Commission. I hope you are familiar with the booklet issued recently by the Association of American Railroads, entitled "Railroad Manual on Employment Stabilization." In August of this year the railroads were made subject to the provisions of the applicable War Manpower Commission stabilization programs.

For the most part, these programs have been locally developed to meet particular local situations, although they must conform to certain minimum national standards. The plan issued recently for the West Coast by the Office of War Mobilization constitutes somewhat of an exception since it calls for the establishment of manpower controls in any West Coast areas when the War Manpower Commission and War Production Board deem these controls to be necessary.

In brief, the minimum standards to which all plans must conform, provide that a worker may not transfer under ordinary circumstances from an essential activity to a less essential activity, and that he can only transfer from one essential activity to another after receiving a statement of availability, in the case of the railways, from his last employer or the Railroad Retirement Board. There are also regulations governing a transfer to a job with a higher rate of pay. Such transfers are prohibited unless they comply with the provisions of an applicable employment stabilization program.

The intent of the regulations under this plan, is to reduce the amount of turnover due to resigna-

tions through the device of the certificate of availability and to give the railroad industry, through the Railroad Retirement Board, first call on workers with previous experience in the railroad industry.

On the Pacific coast, and in an increasing number of areas in the East, a further step has been taken by requiring certain classes of workers or all workers, to be referred to employers only through the United States Employment Service or agencies authorized to make referrals by the War Manpower Commission. In the case of the railroad industry, the Railroad Retirement Board exercises the function of the United States Employment Service. This system requires the establishment of a scheme of labor priorities. Such priorities are ordinarily determined through a labor requirements or manpower priorities committee composed of representatives of government agencies which, either in and of themselves, or through the private companies over whom they have jurisdiction, are claimants for power.

With the inauguration of the West Coast program, a new procedure has been established that is already extending to other areas. This calls for an area production urgency committee sponsored by the War Production Board, to determine the relative importance of establishments in the area and to redistribute facilities or contracts as required by local labor shortages. In addition, the plan also calls for a manpower priorities committee, under War Manpower Commission sponsorship, to rate establishments for manpower allocation purposes. The membership in both committees, aside from the chairman, is usually the same. The Office of Defense Transportation will be represented whenever transportation matters are under discussion. Those of you who operate on the West Coast or in such cities as Buffalo where priorities plans are in effect, should get in touch, through your proper officers, with the Office of Defense Transportation representative, whenever it is necessary to present a railroad manpower problem to the priorities committees.

It would not be possible for me to outline the details of these various stabilization programs as they may affect you. The important thing is for designated railroad officers in the respective areas covered by stabilization programs to inform themselves of the details of the plans covering their particular areas, and then to try to guide their employment policies accordingly. There is an important obligation upon you not to issue Certificates of Availability to your employees unless you cannot avoid it, and not to hire workers from essential activities where such certificates are required. Here is where the exit interview, which I mentioned previously, is of great importance. Plainly enough, it would be pretty difficult for you to avoid giving a worker a statement of availability if he is in any position to exact revenge if you do not issue such a certificate. A certain percentage of such workers, and it is to be hoped, a substantial percentage, might be persuaded, if a competent interviewer is at hand to take the responsibility, to stay on the job and not ask for a Certificate of Availability.

On September 1, the Office of Defense Transportation issued a

13-point program covering railroad manpower. Some of the points in that program apply to your departments and some do not. I should like to review briefly those which do apply.

The first point refers to the desirability of preparing and filing Replacement Schedules. That item I have already discussed.

The second contemplated a special railroad employee recruiting drive with the help of all available Federal agencies. This will be done, of course, only in the area of the greatest need. The Railroad Retirement Board and the United States Employment Service are the principal government agencies concerned in such recruiting drives. The Railroad Retirement Board will have the responsibility in the first instance. Inasmuch, however, as the principal pool of new workers is a pool under the jurisdiction of the United States Employment Service, the latter agency will assist the Railroad Retirement Board by filling orders which the Board itself is unable to fill. In this connection, I should like to call your attention to the very substantial number of placements made by the Railroad Retirement Board employment service. In June, the Board made 36,650 railroad placements, and in July it made 29,276.

While these placements are smaller in number than the railroads' estimates of gross needs, it should be borne in mind that the majority of placements in the railroad industry are still performed through the activities of the industry itself, rather than through the Railroad Retirement Board employment service. That means that even in such tight labor market situations as exist today, the industry has been able to hire an overall number of workers equal to or exceeding its gross estimated needs each month. In certain departments, however, of which maintenance of way and shops are most typical, it has not been possible to hire as many new workers as the railroads need. In the bridge and building departments, as I have stated, carpenters, apprentices, helpers and laborers have not been available in sufficient quantity. It is our hope that by special recruiting efforts a large proportion of these special needs will be met.

The third point in the program refers to the recruiting of additional women workers. When I spoke to you last year, I could not find record of a single woman employed in the bridge, building and water service departments. This year, according to reports obtained by the Interstate Commerce Commission, there have been as many as 152 women workers in your departments. Fourteen of these women were bridge and building painters, 78 were helpers and apprentices, and 48 were laborers. It is significant that these three occupations are the three in which your needs are greatest. The success of the Pennsylvania Railroad in hiring Negro women for track work suggests further possibilities along this line. Most of the new women workers employed in bridge and building are, in fact, employed by the Pennsylvania Railroad. Startling though such an innovation may seem to you, it is certainly worthwhile to at least examine the possibilities of employing a larger number of women in your departments.

The fourth point in the program refers to the establishment of re-

gional pools of workers to be shifted on special assignments to areas of greatest need. I doubt if such a plan is particularly feasible in the bridge and building department. However, a modification of it, which would permit shifts from one division to another on the same railroad, or between railroads at terminal points where several have extensive terminal operations, would seem to be entirely possible.

Mexicans and Prisoners

The fifth point refers to the possibility of employing additional Mexican workers and the use of prisoners of war. As to Mexican workers, there are several points to be cleared up with the Mexican government before additional recruiting may be possible. The use of these Mexicans for bridge and building work, however, is specifically mentioned in our railroad manpower program. The matter of hiring prisoners of war must be held in abeyance until further action is taken by the War Department and the War Manpower Commission.

The sixth point refers to the payment of time-and-a-half after eight hours for maintenance of way work where this is not done. I doubt if this is applicable to bridge and building employees. If it is, arrangements for the paying time-and-a-half after eight hours should be made immediately.

The seventh point refers to action to improve housing, eating and commissary facilities. I have already mentioned this matter and do not need to discuss it further.

The eighth point suggests payment of trainees during their training period where this is not now done. So far as I know, this point is not applicable to bridge and building work.

The ninth point refers to the establishment of a more adequate system of reporting labor shortages. Such a system is now being worked out by the Office of Defense Transportation in co-operation with the War Manpower Commission.

Item ten suggests increased labor-management co-operation. I am sure that this subject is as applicable now as when I talked about it a year ago. I am afraid, however, that very little has been done in your departments in this respect. It takes officers with considerable drive and aggressiveness to inaugurate programs of this sort. I am sure you have them, if they can only be "sold" to the virtues of labor-management co-operation.

Item eleven asks for the establishment of means of giving the railroads a high labor priority in areas of critical labor shortage. That is, in the main, the responsibility of the Office of Defense Transportation. We are attempting to carry out this responsibility through the action of Office of Defense Transportation representatives on labor requirements and manpower priorities committees.

The twelfth and thirteenth points in the program refer to full crew laws and mileage limitations, with which you are not concerned.

Cooperation Essential

When I spoke to you a year ago, I emphasized the fact that the railroads of this country are still privately operated, and that the primary responsibility for the provision of adequate railroad transportation lies in the hands of rail-

road managements, working within the limits laid down by the Office of Defense Transportation, or, in the case of manpower, in most respects, by the War Manpower Commission. It is still true of manpower as of railroad operations—that the primary responsibility is upon you. Your record of accomplishment in this respect is a matter in which you should take great pride—a pride shared by us in the Office of Defense Transportation.

There are many signs that the difficulties of next year, in terms of manpower, will be greater than during the last year. Director Eastman of the ODT remarked recently that the next six months will constitute the crucial period, and that if we can get over that period with success, there is some hope that no future time will present dangers of the same seriousness. Our watchword must be co-operative planning toward a goal which we are all determined to achieve —co-operation between labor and management and the Office of Defense Transportation—co-operation between railroads and the War Manpower Commission—and co-operation between railroad labor and management.

In many respects, it seems to me, it is a good thing that the war has imposed the necessity of greater co-operative action, for it has demonstrated that, by acting together, the railroad industry, including both labor and management, and the Federal agencies concerned with railroads, have been able to achieve results which a few years ago would have been considered utterly impossible. We have learned lessons in meeting these various problems which are bound to result in permanent improvements in the operation of the railroads.

For the general discussion on this subject, see page 57.

High School Boys Make Good in Maintenance Work

By W. G. Powrie

Engineer Maintenance of Way, C. M. St. P. & P., Chicago

(Introduced by President G. S. Crites)

W. G. Powrie

President Crites: Early last spring, the officers of the Milwaukee realized that they would face an increasingly acute shortage in labor and set about to meet that situation. In searching for a solution, it occurred to them that there were many active, able-bodied men in the high schools along their lines, and they proceeded to interest these young men in maintenance work, with results that exceeded their expectations. Through this means, they were able to complete much work which otherwise would have remained undone. Credit for the development of this plan goes largely to W. G. Powrie, engineer maintenance of way, who not only participated in its inception, but who also gave it his active personal attention to insure that it would be a success. Mr. Powrie is one of the younger maintenance executives on our larger railroad systems, having been appointed to this position less than three years ago. He is now engineer maintenance of way of the Chicago, Milwaukee, St. Paul & Pacific Railway System. He will tell us of the results which his road has secured in the employment of high school boys during the last season. Mr. Powrie.

Address by Mr. Powrie

The manpower shortage is requiring maintenance of way men to use their ingenuity to the utmost. Many plans have been advanced for providing more labor for the railroads, such as the use of Japs from relocation centers, the importation of Mexicans, the employment of women, and a general relaxing of physical standards and age limits in recruiting men. One other source of help which has been tapped by many roads is the employment of high school boys.

Child labor regulations in many states allow the employment of boys 16 and 17 years of age on railroad maintenance work, with varying restrictions as to the number of hours they may be worked. In most states, the boys must secure permits to work from the proper state or municipal authorities. In one instance, where the state statutes did not permit boys under 18 years of age to engage in railroad maintenance work, the regulations were amended by special order for the duration of the war so those 17 years old, and later 16

years old, could be employed on such work.

Recognizing the serious effect that the existing labor shortage could have on the proper maintenance of the railroads, the Industrial commission of that state made the following comment in issuing its special order authorizing the employment of boys 16 years of age.—"The fundamental reason for this order is the acute shortage of men available for the work, due largely to the lowering of the draft age to 18 and the acceptance into some of the armed services of boys 17 years of age.

"Information collected by the commission since the adoption of the initial order seems to show rather clearly that the gravity of the situation was under-estimated at the time of the adoption of that order.

"Despite the lowering of the age to 17 for track repairers, it has been found necessary, at least in some cases, to employ women at this work. However, such employment of women offers no real solution of the vexing problem.

"There can be no difference of opinion regarding the vital necessity of keeping our transportation systems in good working order at this time. This cannot be done in the absence of an adequate labor supply.

"The only solution of the problem seems to be in the employment of boys 16 to 18 years of age instead of limiting employment to the group 17 to 18. Even this may not, and probably will not, wholly solve the problem."

In those states that still prohibit the employment of boys under 18, similar action would be helpful The employment of boys during their summer school vacation period and on week-ends has aided the completion of maintenance programs on all roads that have used them

1300 In Track and B. & B. Work

Early last spring a number of our division maintenance officers called on the high school authorities in

Part of an Extra Gang of High School Boys Surfacing a Newly-Constructed Second Main Track on the Milwaukee.

the villages and cities along their division to secure assistance in recruiting boys for work on the railroad. Part-time work was offered in bridge and building crews and section gangs during the months that school was in session, and full-time work was offered during vacation periods. After a frank discussion of rates of pay, working conditions, transportation facilities, and the supervision to be provided for the welfare and safety of the boys, hearty co-operation was secured. This co-operation on the part of school authorities was of great assistance in convincing the boys and their parents that due care would be used in working them, and that they would be treated as boys should be treated.

By April, about 500 boys were lined up for week-end and summer vacation work, and more than 200 were actually working Saturdays and Sundays. With the closing of the schools in June, the recruiting gained momentum to the extent that we had more than 1300 minors on the maintenance of way payroll by the end of that month. This included those employed in track work as well as in bridge and building work.

At one engine terminal where we had quite a large program of water supply work to do, we had a crew of 25 boys installing pipe lines, hydrants, concrete pits, etc. This job probably could not have been done if it had not been for the boys.

Where a number of these young men could be worked in a crew, we enlisted the services of the high school coach or one of the teachers to act as monitor. These monitors were of great assistance in handling the boys, especially in preventing "horse play," practical joking, and in warning them against unsafe working practices. Furthermore, they formed an outlet for any grievances or suggestions on the part of the boys, with the result that sometimes desirable changes were brought about in the interest of both the boys and the work.

Safety of First Importance

Safety is a major consideration in the employment of boys on the Milwaukee, and all other factors are subordinated to that end. Wherever employed, the safe conduct of the boys is put up squarely to the foreman. When first employed, and daily thereafter, the boys are instructed in safe working practices. They are required to familiarize themselves with safety rules, and each day before starting work the foremen impress upon them the great importance of following these rules.

To the extent possible, the boys are assigned to work for which they are best fitted physically. Furthermore, in doing some of the heavier jobs, more boys are used than the number of men usually required. The safety of the boys is a matter of real concern to us because of their lack of experience, and because they are bubbling over with pep as all husky American boys should be. The only satisfactory safety record, of course, is a total absence of injuries. We did not reach that goal, but had surprisingly few injuries among the boys. None of these injuries were of a serious nature.

One important consideration in the employment of boys is the supervisory force in the crew. In the first place, an increased number of lead men and assistant foremen is needed. In addition, the foremen must have great patience and a

keen understanding of boys. They will not respond to gruff orders, but will do anything for a foreman they like. There reactions are quick; their likes and dislikes strong. Some of the most successful foremen had the same group of boys with them steadily throughout the summer. Others experienced a heavy turnover.

Boys doing bridge and building work were taken into the regular camps of the bridge and building forces, but for some track gangs composed entirely of boys, special camps were provided. These camps were equipped with electric lights, running water and shower baths. An effort was made to serve the type of meals the boys liked, which, incidentally, we found to be considerably different from the meals, required by regular extra-gang laborers. At least twice each week transportation was provided to take the boys into a nearby town so they could go to a moving picture show or to the corner drug store for a soda.

Good Power Tool Operators

The quality of work done by these young men is satisfactory. Their lack of experience and skill, of course, makes their progress slower than that of a crew of experienced men, but by working them in with a sufficient number of experienced men they do well. They learn rapidly and are willing and eager to get something accomplished. It is especially noticeable that they like and excel in handling any type of power tool. The boys seem to have a natural ability to learn to operate such tools.

In bridge and building work, the boys are employed largely as laborers and carpenter helpers. On most bridge and building jobs the number of unskilled workers who can be employed to advantage is limited. On these jobs there is not the same opportunity to use large numbers of inexperienced boys as in track work. Experienced bridge and building carpenters and steel bridge erectors are needed, and that is where the labor shortage shoe pinches tightest.

Week-End Work

When the fall school semester opened, we lost the full-time services of the majority of the boys we had employed during the summer. They have been encouraged to remain with us for part-time and week-end work and many are doing so. The help to be gained through the use of part-time workers during the winter months will be quite important to us, and will be exploited fully. In areas where we have a critical shortage of labor, I believe we can prevail upon the school authorities to release the boys from school for short periods to assist in emergency work. This was done in a few instances last winter.

While we all deplore the conditions which make the use of boys 16 and 17 years of age so important to us at this time, we can take satisfaction in the fact that by providing healthy, muscle-building outdoor work for them, we are training some of the world's finest football teams of the future, and, even more important, we are accomplishing much needed work and are training a grand lot of railroad men for the future.

For the general discussion which took place on the labor problem, see page 57.

Extra Gang of Women Makes Good on The Pennsylvania

By Malcolm Young

Track Supervisor, Pennsylvania, Warsaw, Ind.

(Introduced by President G. S. Crites)

Malcolm Young

President Crites: Industry at large is facing an acute shortage in manpower by reason of the diversion of so many men for military service and war activities. To fill the gaps thus created, it is enlisting women in numbers never before contemplated. The railroads are no exception to this practice. Many roads are finding that women can be employed successfully in many tasks not heretofore considered as coming within their scope. No railway has employed so many women or has employed them in so wide a range of activities, as the Pennsylvania. Many of these women have found their way into the maintenance of way work. In casting about for someone who could tell us how the Pennsylvania employs women in maintenance work, we were referred to Malcolm Young, supervisor of track of that road at Warsaw, Ind., and we were told by his superior officers that he had achieved marked success in recruiting and working women. Mr. Young will bring to us a report of his experience and will supplement his report with information regarding the experience of other supervisors. Mr. Young.

Address by Mr. Young

We first started hiring women as crossing watchmen. During the first two months we placed nine of them on crossings through the town of Warsaw, Ind., but during this time two of them said that the work got on their nerves, and we had to replace them. Six of this original group are still working and are doing very satisfactorily; however, some of them do not work as regularly as the men whom they replaced. Our chief problem in using women has been to educate and qualify them for the work. At first we had complaints from drivers because the crossing gates were left down too long before and after trains but, with experience, this difficulty entirely disappeared. We have never had an accident at a crossing protected by a woman which was in any way her fault.

When we first established on my territory a women's extra gang to do track work, which was in December, 1942, a few of our men objected to our employing them for this work on the grounds that they did not do as much work as the men, but were receiving equal pay.

Finally, we brought this matter to a head at a meeting and declined to abolish the women's extra gang. The upshot of the matter was that one man quit while the women stuck. Since that time there has been less and less criticism of their work.

We started the track gang by hiring two women who were relatives of men who had been railroaders for many years. Since then we have built up the gang to twenty-five. There has been less turnover in this gang than in any other extra gang on the subdivision, though the absenteeism has been just about as bad. The women working for us now are about equally divided between those who have come to Indiana recently with their husbands or other relatives. We have found that keeping families together is one of the most effective ways of holding our labor. We have encouraged men moving into our territory to bring their families and to settle near their headquarters. We have tried to help them find and rent homes, or, to find small farms.

One man moved to Warsaw last year and since has been joined by his wife, two sisters-in-law, a brother-in-law and his brother-in-law's wife; all six of them are now working on the Pennsylvania tracks. Two more of this man's relatives are coming up from Kentucky soon to work, and plan to bring their furniture.

Have Accomplished Much Work

Starting the women's gang in December, we had some trouble during the cold months immediately following finding suitable jobs for the women to do. We made a few false starts, but during the winter the gang levelled and boardlined six miles of crushed stone ballast; loaded and unloaded all cars of material, except those handled by work trains, including scrap, splices, crossties, tie plates, tools, etc.; cut all of the brush along ten miles of right of way; shoveled snow from platforms and sidewalks and swept it from switches; and helped lay two miles of 100-lb. rail. On this last mentioned work, they unloaded and loaded all of the material involved, except the rail.

The work they like least is levelling stone ballast. They prefer work that they know is actually

Extra Gang of Women Renewing Ties and Surfacing a Siding on the Pennsylvania at Larwill, Ind.

helping to keep the railroad running. They want to feel that they are really helping to win the war.

Not Amazons

These women are not Amazons; none of them can spike ties, except one, and she isn't very good at it. They are white, and of various weights, from 105 to 180 lb. They like the work and like working on a railroad.

The foreman in charge of the gang has been more largely responsible for its success than anyone else. He started the gang, stuck with it, and is proud of it. If he thinks the women are becoming too tired, he tells them to sit down and rest, but if he thinks they are loafing, he gets tough and tells them so. When we established the gang, he was one of few who believed that it could succeed, and he has made it a success.

The gang is composed of the foreman, an assistant foreman and 25 women track laborers. Twenty women are about the most that ever report for work on any one day. At present, there is also a man truck driver in the gang as the gang is raising a passing siding 35 miles from its headquarters. The principal job of the assistant foreman and the truck driver is spiking ties; the remainder of the time they help put in ties. The women do everything else, including the handling of the jacks. During an average eight-hour working day, they raise fifteen 33-ft rails and put in 40 side-track ties. They have been doing this work steadily since last spring, and in six and one-half months they have raised seven and one-half miles of passing sidings and one mile of yard track, and have installed 3,000 ties. In addition, they have leveled the stone ballast on eight miles of track.

Need Special Training

We have tried to educate the women to know what they are doing, and why. I asked three of them one day why they were raising track, and they didn't have any idea. When the foreman started telling them what they were doing and why they were doing it, both the quality and the quantity of the work improved almost at once.

There were four personal injuries in the gang during the first five months of its existence. The first occurred when two women were lifting 200-lb. kegs of spikes over the side of a gondola, instead of rolling them on a plank. One of them strained her back when lifting the fourth keg. The other injuries were cut and bruised fingers while handling material. Since May, however, no one has been hurt. Apparently it took that long to convince some of them of the real importance of safety rules, and for them to become accustomed to their new work.

On our St. Louis division, we have employed women in the bridge and building department as painters, with some success. The principal trouble has been that there have not been enough of them to warrant putting a foreman in charge of them.

A good gang of women who really want to work can probably do about two-thirds of the jobs that the same number of men will do, though not so fast or so skillfully. They can paint, weld, cut, adze and use an axe, saw, hammer or plane. They can dig, shovel sand and gravel, and push a wheel barrow if it is not too heavy. Jobs they cannot

do include heavy lifting, spiking, heavy riveting and those classes of carpentry, steelwork and masonry work which require years of training and practice.

We now have approximately 21,500 women working on the Pennsylvania. Many are in our car and machine shops. Others truck freight, drive trucks, wash engines, clean cars and handle mail. There are also a few in train service around Philadelphia. It is no longer a case of whether women can help in railroad work, but rather one of being able to get them to work, for in our part of the country they are becoming almost as scarce as men.

Summarizing the experiences of the last year, the following principles relative to the employment of women can be laid down: (1) So far as possible, women should be kept in gangs separate from men; (2) Give them a good foreman who believes they can succeed; (3) Don't pamper them; (4) Educate them and tell them why the particular work is being performed; and (5) make them realize that they are helping to win the war.

For the general discussion which took place on the labor problem, see page 57.

Part-Time, Week-End Workers Aid Substantially

By L. E. Peyser

Principal Asst. Arch., Southern Pacific, San Francisco, Cal.

L. E. Peyser

During 1942, when a Southern Pacific main-line trestle caught fire, the agent at a nearby town appealed for assistance to the local volunteer fire department. The immediate response and effective work of this organization saved the greater part of the structure. The superintendent of the division upon which this occurred was greatly impressed by the way this organization had mobilized its manpower to fight the fire and reduce delay to important military and civilian trains. He was still thinking about it a few months later when, because of a shortage of freight handlers, a large yard began to choke up with freight cars that were waiting to be unloaded.

On an impulse, he communicated with the agent, explained the problem and asked what he thought might be done to get local people to lend a hand again. The following Sunday, the agent put a total of 40 college professors, bankers, storekeepers, clerks and farmers aboard a train for the short ride to the choked yard. A week later he dispatched these same men and 60 more. The cars were unloaded and the jam was broken so that the yard could function normally to handle the huge volume of military and other freight that passes through it. Asked how he had recruited the men, the agent said: "I just walked down Main street and told them we needed some help."

A little later, the same group helped out on a few Sundays, handling baggage at another point Following this, as their latest and perhaps most unusual job, these same men helped relieve a serious shortage of track maintenance men, and on each Sunday, about 45 men have been working from eight to ten hours swinging picks and shovels and handling tampers. Practically all of them are "white collar" men during the remaining six days of the week, but they were eager to do a day of real war work for prevailing laborer's wages on the seventh.

Appeal Broadcast

This local experiment having been so satisfactory, the idea was broadcast, and business and professional men in other towns and cities along our lines where track-

work was needed, were asked to sign up for week-end work. The response was both gratifying and somewhat surprising. Students from universities, junior colleges and high schools made up the bulk of these temporary forces, but workers from practically every business and profession were represented. These patriotic week-end workers came in response to advertising appeals placed in various cities on our lines, in some cases to announcements on local radio stations, and in others to personal appeals by station agents in their communities.

Furthermore, letters were addressed by our management to local bodies, such as chambers of commerce, telling of our needs and the approximate number of men that could be used.

The success of the campaign is reflected in the following tabulation of man-days worked by these week-end workers. Sundays, over the entire Pacific Lines:

Date (1943)	Man-days
April 4	4,162
11	4,460
18	4,525
25	3,504
May 9	3,629
16	3.588

Subsequent drops occurred, due probably in large measure to annual vacations and to students obtaining full-time jobs during their vacation periods. Adding to this, the seasonal demand for farm, vineyard and orchard workers, widely publicized in California, has reduced considerably the available pool of possible recruits.

The work performed by these week-end forces consisted principally of spot surfacing track, cleaning ballast, laying rail, raising track, installing switches, making tie renewals, cutting weeds along the right of way, unloading crushed rock from cars and other routine tasks. The work performed has been satisfactory, but the plan must be considered as a relief measure only, and not in any sense as a complete solution of the problem of track-labor shortage. None of this week-end labor was used in bridge, building, water service or welding work, which requires skills not readily available in men without previous training in these crafts

Other departments are availing themselves of help from this source, particularly the stores department, where part-time or week-end workers are used to load supplies, unload scrap, sort scrap and to unload and load lumber. In our wood-working mills, a limited number are performing the simpler mill processes which do not require the use of power-driven tools, and some are employed in the manufacture of small pre-fabricated structures. In this case, if skills are discovered in the men, they are used to the best advantage, with consequent greater remuneration. At each of two points, 50 to 75 men are employed each week-end in this type of work, and a smaller number of men are employed at each of several other locations.

For the general discussion which took place on the labor problem, see page 57.

Men—How to Secure and Hold

Report of Committee

M. D. Carothers (chairman), chief engineer, Alton, Chicago; E. E. Tanner (vice-chairman, water service), general supervisor bridge and building, N.Y.C., New York; Neal D. Howard (vice-chairman, buildings), managing editor Railway Engineering and Maintenance, Chicago; H. C. Crawford (vice-chairman, bridges), bridge and building supervisor, S. P., Dunsmuir, Calif.; G. S. Crites, division engineer, B. & O., Baltimore, Md.; Abraham Frazin, engineer draftsman, C. & N.W., Chicago; Garth H. Holmes, supervisor bridge and building, M.P., Falls City, Neb.; A. M. Knowles, engineer structures, Erie, Cleveland, Ohio; P. L. Koehler, division engineer, C. & O., Ashland, Ky.; M. Meyer, Sauerman Bros., Chicago; and Dee Worlow, bridge and building foreman, M.P., Kansas City, Mo.

M. D. Carothers
Chairman

One of the most critical problems confronting the railways today in their efforts to meet the heavy demands of war transportation is their inability to secure sufficient labor—labor to replace losses to military service and war industries, and labor to increase the size of their crews to the point necessary to meet the largely increased demands being made for service. According to the latest report of the United States Railroad Retirement Board, dated September 1, 1943, the personnel needs of the railways in all departments, as reported to the Board by 193 roads, including the 30 largest railways of the country, reached a new high of 96,361, an increase of approximately 17,430 over the shortages reported a month earlier, and an increase of 55,451 since December of last year. No one need be told that such a situation is serious, especially with the prospect that, in spite of all efforts to the contrary; it will become still more serious.

The same report of the Board for September 1 shows that of the 193 roads covered, more than 70 reported shortages in bridge and building employees, ranging up to 50 per cent of their present requirements, and totaling approximately 4,200 men, or about one-ninth of the total number of bridge and building employees on the railroads in normal years Among those classifications showing the largest shortages are carpenters —1,043, carpenter's helpers—325, bridgemen—58, bridge and building helpers—1,139, bridge and building laborers — 499, mechanics — 340 painters and painter's helpers—273, and water service men—103.

That this shortage prevails is not surprising. In the first place, the bridge and building forces have contributed their share to the armed services. Then too, composed largely of skilled men, they have been sought by war industries and military projects that have been in need of such men, and that have often held forth the inducement of subsantially higher wages. The losses that have been sustained in manpower are serious

enough in themselves, but they are made the more serious by the shortages prevailing in many of the materials, and in work equipment, that are essential to the efficient repair and maintenance of all classes of railway structures. Adding to this is the increasing difficulty of finding contractors who will undertake railroad work, many of them facing the same manpower shortage as the railroads themselves. This overall labor problem of the bridge and building forces is one which they alone can solve, and they must solve it to the greatest possible extent. To do this will require the utmost effort on the part of everyone in the department.

Fundamentally, the solution of the problem lies along two lines—the securing of additional manpower wherever possible, and the holding of present forces. These, in themselves, present difficulties, first because of the serious defficiency in the overall labor pool of the country, and second, because of the demands of the military forces for more men, now including the younger married men, and the inducements, often temporary in character, that are still being offered by war plants and other industries competing for the still employable labor of the country.

Must Seek Men Diligently

How can new men be attracted to bridge and building work, and what means are available to prevent or discourage deflections from the present ranks of bridge and building men? Discussing first means of attracting the needed men to fill out the bridge and building forces, it is axiomatic that men will not be attracted who are not aware of the various positions open to them in bridge and building work, or who are not sufficiently apprised of the advantages inherent in employment in such work. The day when an adequate number of men present themselves to the railways seeking employment is past for the duration. Today, the railroads must seek out the men they need. They must do more than that in most cases —they must bargain shrewdly in the available labor market with other industries which are diligently searching for manpower—not necessarily on a dollars and cents basis, but on the basis of all of the advantages that accrue with railroad employment, and there are many.

In normal years of the past, needed additional manpower in the bridge and building department has been acquired largely through the interest and effort of bridge and building foremen and their men in contacting relatives, friends or acquaintances. While these measures have proved adequate under many situations in the past, it has become increasingly evident that to secure the necessary men today, the efforts made will have to go beyond these two measures to include intelligent, informative and appealing advertising in local newspapers, and a concerted effort on the part of foremen and their men to seek out for employment not only available men from among their friends and acquaintances, but desirable men anywhere in their communities. Advertising their needs is most important. Every metropolitan and town newspaper in the country today contains column after column of "help wanted" advertisements, placed by industries that are sparing no expense in their effort to secure men. Furthermore, many of these advertisements list every conceivable advantage offered through employment in the companies concerned. Today, when additional manpower is so essential on the railways, and when the

available supply is considering the advantages of jobs more carefully than ever before, the railways cannot afford to overlook this type of appeal.

It is a well-known fact that thousands of carpenters, plumbers, painters and embryo artisans of all kinds, who left their normal pursuits to work on army camps and other military projects, are again back in their local communities, employed on minor construction and repair jobs. Such men should be contacted and appraised not only of the needs of the railways for labor, but of all of the advantages that accrue through employment in railway bridge and building work.

It must not be left to these men to approach the railways of their own initiative. Rather, where the need is great, the loyal bridge and building men now employed on the railways must set out in a concerted effort, as a specific assignment, to contact every available steelworker, carpenter, painter or man capable of working as a helper. To the end of securing men also, they should keep track of local construction jobs, looking to the possible employment of the men who may be out of work upon the completion of those jobs. These efforts must not be hit-and-miss—they must be on an organized basis, taking some company time, if necessary, to cover the field thoroughly.

In addition to these efforts to fill out their ranks, bridge and building men should enlist the interest and active support of every station agent in the employment of men, and these efforts should be supported by placards displayed in every station. Furthermore, contacts should be maintained with local employment agencies and followed up closely. A few roads, discouraged with the results secured through labor agencies, have employed labor recruiters, these men working on a salary basis, plus expenses.

Supplementing these different efforts, the various departments of the railways should co-operate with each other to the fullest extent in helping to meet their manpower needs. If men apply for positions in the bridge and building forces who are not fitted for any of the classes of work that must be done by these forces, an attempt should be made to find whether they would fit into any of the other departments of the railroad in need of men. Likewise, no other department should dismiss from consideration applicants for work if there is a possibility that they could be employed constructively in the bridge and building department.

Still further supplementing these efforts to secure men, the facilities of the United States Railroad Retirement Board should not be overlooked. At all times, a road's specific requirements should be kept before this board. That it can be helpful in many instances is seen in the fact that as recently as last July this Board arranged for 29,276 placements on the railroads, and during August this number was increased to 36,090.

Change Standards of Employment

Contrary to practice in the past, the recruiting of bridge and building manpower can no longer be confined to skilled men between the ages of 21 and 45. Most roads have found it necessary to lower their age requirements and to raise age limits. The track departments of a number of roads during the last summer made extensive use of boys below military age, with large success, demonstrating that many boys are capable of highly constructive work. Only a few roads have as yet attempted to

Boys Can Be Employed for a Wide Range of Exterior and Interior Painting Work

employ boys in bridge and building work, but where they have been employed, their work is reported as satisfactory. One road has employed boys successfully in a variety of helper operations, and has found them agile and willing workers. Another road has found boys particularly helpful in painting work.

It is recognized that greater care must be exercised in the selection of boys for bridge and building work than is required for track work, because of the generally greater skill required in most bridge and building operations. However, it must be recognized that many boys have innate skill and precision, with special aptitudes for carpenter and general construction work. The problem is to search out these particular boys, and to interest them in employment during their vacation periods. Whether it would be practical to employ them week-ends during the remainder of the year, as is being done by the track departments of some roads, may be open to question, but, where the need is great and the character of the work lends itself, even this possibility of supplementing the output of present bridge and building forces should not be overlooked.

Few, if any roads have as yet attempted to employ women in bridge and building work, but some are seriously investigating the possibilities in this regard, particularly for certain classes of work carried out in bridge and building shops and in and about terminals. It is common knowledge that women are being employed in locomotive shops and enginehouses on many roads, with considerable success, taking over work that formerly was considered the province of men. It is likewise true that women are being employed in considerable numbers in maintenance of way work equipment repair shops, not alone in operations of secondary importance, but as mechanics, repairmen and machine operators. These facts, and the knowledge that hundreds of thousands of women are today being employed manually in industry generally, indicate that where the need is sufficient, the possibility of their being employed to help fill out bridge and building gangs—as helpers, as tool or machine operators, as painters and for clean up work about carpenter shops, should not be overlooked.

Still another possible source of manpower for certain classes of bridge and building work, although

recognized as a limited one, is from the ranks of recently retired employees. Men should be encouraged to stand by their gangs as long as possible, or until the situation has eased.

Serious as are the needs of the bridge and building forces for additional manpower, one note of caution is in order. While it is not to be expected that under present conditions past standards as to age, skill, health and mentality can be maintained in seeking new employees, it is important that those who are brought into the bridge and building forces have the right attitude toward their work. Those of undesirable character, poor or unstable habits, and with discontented minds, should be avoided. Such men are trouble makers, and rather than a help, regardless of their manual skill, are demoralizing to an otherwise loyal and contented force.

Must Hold Present Employees

Important as is the need for securing new men to fill out the ranks of the bridge and building forces, it is no more important than that of holding on to those desirable men already in existing forces. Fortunately, most of the means to this end are common knowledge to those with any insight into human nature. Therefore, attempt will be made here only to review briefly the various factors involved and the means at hand.

At the outset, it must be recognized that labor today, more than ever before, seeks congenial and favorable working conditions, with adequate remuneration and minimum unnecessary inconveniences. This is particularly true of the higher class of labor that is needed generally in bridge and building work. Fundamentally, this calls for steady employment; for clean, sanitary and comfortable camps; for adequate, nourishing and well-prepared food in camps; for safe working conditions; for the greatest convenience in keeping in touch with their families; and for an attitude of fairness and consideration on the part of their superiors. With these conditions met, which are well within the realm of possibilities in bridge and building work, loss of manpower from existing forces, despite attractions of other industries, should be a minimum.

Stabilize Employment

Bridge and building work, as most other types of railroad work, has a fascination for many men, but fascination alone is not enough to hold most men under the conditions that prevail today. Most men of the type needed in bridge and building work want steady employment. Therefore, more than ever before, a serious attempt should be made to program work continuously throughout the year. Many roads have found that such work can be so planned with efficiency and economy, reserving for the winter months such work as heavy bridge repairs, the painting of building interiors and the repair of stations, freight houses, shops and enginehouses. As pointed out in an address before this association in 1941, by P. O. Ferris, chief engineer of the Delaware & Hudson, a road that has had remarkable success in stabilizing its forces, "It is essential that a road get a reputation for providing year-around employment."

Good Camps and Food

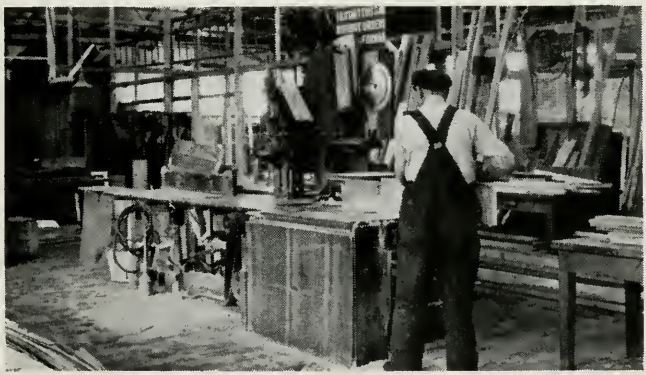
Where bridge and building men are required to live out on the line, away from their homes, they should be provided with suitable living quarters. Such quarters should be clean, sanitary, well-ventilated and capable

of being heated comfortably in winter. Furthermore, it is desirable that they be provided with adequate room for recreation purposes; with shower baths with hot and cold water; and with electric lights, either from portable electric generating sets or from available commercial power lines. Where cars are not available for such living quarters, consideration should be given to other types of living quarters, including the portable, readily assembled and dismantled buildings of various sizes and types that are now available on the market. These buildings, which can be transported conveniently from one point to another, should be handled readily by men acquainted with bridge and building work, and highly suited to their needs for convenience and comfort. In this regard, it is not without significance that one road has recently purchased 60 housing units of this type for section and extra gang labor, and has 20 additional units of this type on order.

Adequate, clean and nourishing food, rationing to the contrary, is just as important today as ever. As recent as October 6 of this year, the chief maintenance officer of an eastern road wrote—"We are firmly convinced that good food in liberal quantities, and clean, comfortable housing conditions are essential and attractive to labor." The railroads should render every assistance possible to the end that the men in their camps secure their fair share of the food that is available, and see that it is prepared and served in a sanitary, attractive manner. So far as bridge and building gangs are concerned, where the men generally arrange for their own food through a cook furnished either by themselves or by the railroad, this is a definite responsibility of foremen, master carpenters and bridge and building supervisors.

Convenient Transportation

Most bridge and building employees are family men. Those working in and about terminals desire to return home as soon as possible each night, and those out on the road desire to get back to their homes weekends at frequent intervals. This desire on the part of the men must not be disregarded. On the contrary, every effort should be made to meet it. To this end, many bridge and building gangs are equipped with highway trucks, which enable them to work as far as 50 or 60 miles from their headquarters and to return at night. These same roads and others



Women Can Be Employed to a Limited Extent in Bridge and Building Wood-Working Shops

are liberal with pass privileges to employees desiring to return home week-ends, and both of these measures have been found highly effective in maintaining morale.

Holding employees also demands that the work be done safely. Few men today want to work where unnecessary hazards prevail, where safeguards are lacking, and where fellow workers are allowed to be careless, jeopardizing the safety of all. That bridge and building work can be done safely has been demonstrated unmistakably over the years. No railroad today asks its men to undertake unsafe operations. In fact, they have spent and are spending thousands upon thousands of dollars yearly to educate their employees in safe methods and practices. The extent to which these efforts prove effective is largely the responsibility of foremen, supervisors and master carpenters. They must see that adequate safeguards surround every class of work, that their men are dressed properly, that undue haste is avoided, that their men are instructed in the safe and correct methods of doing work, and that the careless habits of any of them are corrected promptly.

Must Offer Rewards, Incentives

With the profit motive instinctive in almost everyone, especially in times when living expenses and other obligations are on the increase, this motive cannot be overlooked. To increase the over-all income of those employees who desire such increase, many roads, in their urgent need for getting essential work done, are allowing these men to work beyond eight hours a day—some nine, some ten—at the option of the men themselves, paying them time and one-half after eight hours. Where this is desirable from the standpoint of the railroad and desired by the men, it is, unquestionably, a practice that will aid in holding some men who might otherwise be attracted elsewhere by higher wages.

Furthermore, in an effort to hold the better men in gangs, especially as men are lost to the armed services or other industries, consideration should be given to re-classifying or up-grading those men who remain, giving them the advantage of moving up to fill vacancies. Wherever this can be done on the basis of merit, it is in the interest of the men, the gang and the railroad, and should be done. At all times, those in the bridge and building forces should be made aware that there is a chance for their advancement—that a premium is placed on faithful and efficient service. To this end, foremen, and at least some supervisors and master carperters, should be promoted from the ranks, and every opportunity should be given other loyal and efficient employees to better their condition.

More than ever before, the morale of any bridge and building crew depends upon the foreman. He must have experience, intelligence, a good disposition, and unquestioned character. He must assume the responsibility of thinking for his fellow worker, keeping in mind that success in his work is primarily the art of transferring ideas from his head to the heads of others. He must be a good teacher. He must be confident in himself and stimulate confidence in his men.

Deferment of Essential Employees

Having given consideration to all of the foregoing factors in an effort to hold men, there is still one factor that has a fundamental bearing upon the holding of those men sought by the military forces. This is the seek-

ing of deferment of those men who, either because of their skill or experience, are essential to the work that must be done. Rightly, the railroads have been reticent in asking deferment for any of their men below the rank of foreman, but as the drain upon these men has become increasingly severe, many of them have had to modify their practice in this regard in the interest of insuring the safety and adequacy of essential rail transportation. Where this is necessary, it must be done. In fact, it is the duty of the railways to seek such deferment for their essential employees. Authority for this latter statement is none other than E. M. Fitch, assistant director, Division of Transport Personnel of the Office of Defense Transportation, who said before the annual meeting of our association last year, in part, as follows:

"If you have men in these occupations (bridge and building and water service foremen, bridge and building ironworkers, bridge and building painters, pipe fitters, plumbers, timekeepers, welders and operators of the heavier types of portable equipment used in bridge and building operations) who might be placed in Class 1-A, except for their occupation, or whom you cannot let go because you are unable to replace them within a reasonable time, it is both your right and your duty to submit on Form 42-A all the data which the Selective Service System requires in making decisions as to occupational deferments.

"You should take Form 42-A very seriously and fill it out as completely and as fully as you can, making it apply as much as possible to the individual for whom you are requesting deferment."

Two other factors are mentioned in this report, not as in the direct interest of helping to secure or hold employees, but in the interest of the equally important matter of getting the most effective work from those men already employed. One of these is the use of power tools and work equipment as widely and as effectively as possible to reduce the physical energy required to carry out necessary work, and to increase production per man-hour employed. This may be a greater factor than ever before as the average age of regular employees increases with the loss of younger men to military service and other industries, and as boys of less than military age, with limited physical endurance, are employed in the gangs of various types to help fill out the railway maintenance forces.

The other factor is that of protecting the health of every employee—first by measures on the job that will keep him physically fit, and second, by every means to restore him to health as rapidly as possible in case of illness. While the latter is not the direct responsibility of the railways, supervisory officers in the bridge and building department, including foremen, should make it their business to see that their men are adequately taken care of in times of illness, looking to their resumption of work at the earliest possible date.

GENERAL DISCUSSION ON LABOR

President Crites: One or two points have been brought out on which a few additional comments might be helpful to the members of the Bridge and Building Association. One of these points is with regard to labor and management co-operation. Since 1923, the Baltimore & Ohio has had co-operative

meetings between the shop crafts and the management, and I believe this practice was extended to the lines of the Canadian National. Many of the suggestions made by the shop crafts involve work to be done by the bridge and building forces, and there might arise a feeling among these forces that they are being imposed upon. The only way to overcome such a feeling is to join in these co-operative meetings by having the bridge and building supervisor or master carpenter, or the foremen involved around the shops, sit in these meetings with the attitude that the men as a whole are fair and do not want to treat anyone unjustly, or impose upon them. If this is done, many complaints or suggestions that get onto the co-operative minutes can be treated locally, amicably and with fairness and justice.

In analyzing the amount of work required of the bridge and building forces to take care of co-operative suggestions, it was found that only about 8 per cent was not on the regular program for the year's work, and when this 8 per cent was analyzed, it was found that about two-thirds should be done. So, to maintain good relations between management and men, it would seem that the bridge and building department can well afford to do the small amount of work without complaint, that appears as co-operative items.

Women in B. & B. Work

As to employing women in bridge and building work, I can only report rather negatively. I had a territory that extended through rather scattered agricultural country for about 700 miles, where conditions were such that is was possible to permit of a lot of painting and other deferred work—not particularly for the safety of the structures, but for their maintenance and protection. Labor in this particular territory was highly unionized, and in our bridge and building forces we had only mechanics. Yet there was much work that could be performed by helpers.

When it came to painting and work of that nature, where helpers would be quite useful, there was not the increase in the gangs that I had expected because, I assume, the foremen who did the employing, wanted capable, competent and able-bodied mechanics. In one locality, I told the foreman, "Well, if you can't get suitable helper labor among men, I am going to put on women. The work has to be done." The suggestion caused consternation, but it was found that high school boys, and men who were able but not strictly mechanics, could be recruited as helpers, and through their use, a lot of work was done. Incidentally, through the recruiting of this force, a number of mechanics have been developed in that particular territory. This indicates that the foreman must be educated to the changing conditions and times.

Another item is truck drivers. We are obliged to use trucks to transport our bridge and building men, and in one case I found that a small, agile woman, weighing about 115 lb., would cover exactly twice as much territory as would a man driver. Women can also operate small hand tools.

Mr. Young touched on the subject of the load that women can carry. I had a great deal of experience in the employment of women in 1918, and recently, and I have

found that women can handle regularly, at moderate speed, about 25 lb. When the load gets heavier than that, they play out. Another thing, their wrists are not as strong as those of men who have done manual work constantly. If you are employing women to drive nails, for instance, you must change their occupation after a few hours —put them on some work where they will not have the same strain on their wrists.

In employing women, it is best to have a man foreman. There may be rare exceptions. In 1918, in a territory where there was no labor, I recruited a gang of Polish women who had worked on railroads in Europe, and with them I employed a woman who had worked in the capacity of foreman in Europe. It was her responsibility to see that she had a gang of 26 husky women every day. In that particular case, the women were broad and hefty, and their efficiency far exceeded that of itinerant workers.

The territory in which this gang worked was a manufacturing center, and the labor recruiters for one of the manufacturing firms tried to take these large Polish women from us. They wanted the larger ones particularly, and while I do not know whether they connived with my foreman or not, it is a fact that although I continued to have 26 Polish women, they gradually diminished in size, the larger ones going to the manufacturing firm.

Mr. Young outlined methods of securing women. I had a point where men were not available to perform the amount of work that was desired and we recruited a gang of women locally. First preference was given to the wives of railroad employees who had joined the armed services; second, to the widows of railroad men; third, to the wives of men in the neighborhood who had joined the armed forces. That is as far as we had to go.

To insure suitable moral conditions within and surrounding this gang, I pointed out to two of the women who were high school graduates and who had married sons of track foremen, that I expected the gang to police itself. I told them we were very proud that they wanted to do patriotic, essential work for the railroad, but that it was the gang's duty to police itself. About a week later, when I went out to the point where this gang was working, one of the girls said, "You know, with all the small rocks there are around here, I don't know why she picked up such a big one to hit me with." They were disposing of one of their crowd; policing their own gang. We got a lot of work out of those women. That is just a point to remember when we have to hire women in carpenter gangs.

Armstrong Chinn (Alton): I think we all fully agree that the No. 1 problem of the railroads at the present time is labor. No matter what department you get into on a railroad, the first thing you hear from the head of the department is that he does not know what he is going to do because he can not get anyone to do this or that job, or he does not have enough men as a whole. We should all be very grateful to Mr. Fitch for coming here to talk to us, because I can say without reservation that I think he has given us the most comprehensive over-all picture of the labor situa-

tion we have heard. However, after hearing his outline of this situation as it is, I must say that I do not find much encouragement in it, because I think it is true that every man who is physically able and who is willing to work is working, so that if we do get men or women to work on the railroads, we will have to take them from some other occupation. With the wide differential between the rates of pay on the railroad and in war industries, we are at quite a disadvantage in competing for employees, particularly those to be hired on a temporary basis. In other words, we do not have a pool of unemployed people from which we can draw as we did a few years ago; we must look to new sources.

Mexican Labor

While the addresses by Mr. Powrie and Mr. Young, as well as the statement by Mr. Peyser, and our committee report have given us some ideas as to where we might look for new employees, or additional help, I have been disappointed in the situation with respect to Mexican labor. I had hoped that during this period of emergency, we could get this labor more freely, as we did during the last war. However, with the restrictions and requirements now surrounding the employment of Mexican labor, I am afraid it will not prove to be a very great source of help. I agree with Mr. Fitch that it would not be a wise move to use German prisoners on the track. We might use Italian prisoners with safety, but besides the War Department hurdle, there are others that would have to be taken before we could use that source of labor.

With regard to the replacement schedule, I might say that a few weeks ago I attended a meeting of railroad executives in this territory, at which it was agreed that all of the railroads, in this territory at least, would file replacement schedules. Mr. Eastman, director of the Office of Defense Transportation, presented the problem in a light that made it seem advisable for all railroads to file such schedules, and I believe that they have either done this or are now in the process of doing so. I hope that this will help us retain the employees we have, who are so essential for our work.

Upgrading No Solution

Mr. Fitch pointed out that in the upgrading of employees, we create vacancies for laborers. Unfortunately, right there is where we have our most critical shortage—laborers on the track, laborers in freight houses, and laborers in the shops and in the roundhouses. A locomotive engineer may be a critical employee for whom you can get deferment, but if you have no fire knocker to knock the ashes out of the engine, the engineer is not going to run it very far. So, in the long run, the laborer is just as important as the so-called critical employee.

The railroads today are carrying the heaviest burden that they have ever carried in their history. As some of the speakers have pointed out, a tank is of no use at a war plant; it must be at the front to be effective. To get it there, transportation is required. Railroad men today, therefore, have a great responsibility in maintaining our transportation on the home front, since it is so necessary to the suc-

cessful conduct and outcome of the war.

W. A. Huckstep (M.P.): On the question of housing, one of our divisions is taking a standard linemen's tool house, approximately 10 ft. by 28 ft., and is subdividing it into two living rooms, the thought being that after the present emergency is over, these houses can be utilized in regular service.

A number of the railroads today are unable to obtain labor. As a result, their programs are being delayed and their maintenance work is piling up. Money is coming in but it is going into excess profits taxes and is not being used for maintenance. Many railroads have had to resort to contracting program maintenance work, and some have done this very extensively. If anyone here has had any experience along this line, I would like to know what success they have had with it and what reaction they have had from their own men.

F. G. Campbell (E.J.&E.): Mr. Crites, in view of all we have learned at this meeting, I think the two days spent at our war-time conference will prove well worth while.

Experience with Boys

We have had experience during the last year with both high school boys and women, and it is interesting to know how closely it parallels that of Mr. Powrie and Mr. Young in some respects. Our experience with high school boys has been somewhat different than that of the Milwaukee in that we were not able to organize and have the facilities for special gangs. We augmented our regular section gangs with them and, as Mr. Powrie said, success in their use depends largely on the foreman. With the exception of one or two foremen, our experience with the boys was very successful. A foreman who understands boys and knows how to work them will get a lot of work accomplished. Our boys were interested and I think they were much better laborers than the upper age men that we had to hire on the same class of work. Not only that, they were safer and took more interest in the work than the older men did.

We have employed both colored and white women. Incidentally, we have found the white women to be much more intelligent and efficient workers. A gang of white women will do a great deal more work than a gang of colored women of the same number. Also, as Mr. Young pointed out, the young and smaller white women will do the best work, but for some strange reason—and I think this has been the experience of others—with the colored women, just the opposite is true; the middle-aged, heavy colored women are the best workers; the small ones are not as good

We have not contracted any maintenance work this year. We thought about it and talked to the union organization chairman about it, but they were opposed to it. However, there was nothing in our contract to preclude it, and we could have gone ahead if we had insisted. We did contract a small track construction job, requiring grading and track work, and on this we were forced to pay approximately twice as much as our regular track labor rate. However, by contracting the work, we got work done that would never have been

done, providing a much needed facility. From that standpoint it was a success, but from the standpoint of cost it was not. This was not through any fault of the contractor as he was reliable and his superintendent and foreman did the best they could to get the work done. But their laborers were no more efficient than those we were using and paying only half as much. In fact, their laborers were generally not as efficient as ours, because, whatever else you want to say about them, our hobo track laborers do know railroading. Furthermore, the labor turnover among the contractor's men was just about as great as ours.

I was talking to a labor agent the other day who is handling some work on the West Coast for railroads. He told me that they are paying $1.00 an hour for contract labor out there, and that their turnover is just as large as our turnover here.

Labor Turnover

I think, as Mr. Fitch pointed out, that our greatest problem is labor turnover. On one division where the average number of track laborers working during the past 18 months has been about 300, we have actually employed more than 3,550 men. Now, that may be a little startling, but I do not believe that our experience in this regard is greatly different from that of any other railroad employing labor within a radius, say, of 80 or 100 miles of Chicago. It probably is not nearly as bad in some other places, but there is, unquestionably, an enormous labor turnover quite generally.

This turnover shows that we are getting the labor for track work, and I refer to that also because, as Mr. Fitch pointed out, and as his statistics indicate, it is in track labor, which is also called common labor, and in the laborers and helpers needed in the bridge and building department, that our great problem lies. We can apparently hire these men, but we cannot seem to keep them. I think that in many cases this is not because they are going to other industries, but probably because they are moving from one railroad to another.

I do not know how that can be stopped for there is a hobo psychology to be considered. They are going to work just so long at one place and then go on to another, and will continue to do so just as long as jobs are available. I do not think that this situation can be changed entirely, although with proper foreman training it could probably be alleviated to some extent.

President Crites: Two subjects have been brought up on which I would like to comment. One is contracting. If you have a stabilized, regular bridge and building force, I do not think you will have any complaints if you contract all of your new work, because so long as you keep a stabilized force, the men in the field see more structures going up and more work in the future, and as long as they feel secure in their jobs, they will not complain. I can see how there might be complaints with reference to contracting straight maintenance work on bridges and buildings other than large painting jobs, which the men on the division or on the system realize would be too large for them to handle.

As to inducting bridge and building men into the army, too few of

our bridge and building supervisory force realize that the local draft boards have no good way of knowing whether a bridge and building man is indispensable or not. It is their duty to get able-bodied men into the armed forces; that is what they are supposed to do. In one territory under my jurisdiction during the early days of induction, the supervising officer, and, if necessary, I, would go to the local draft board with an appeal for deferment. As a result, we were never once turned down on anyone that we wanted to retain. In one or two instances, we recommended that they take someone else. At the present time in the vicinity of Baltimore, mechanics are not plentiful, but we have not lost any when we have shown to the draft board that they were essential to our work—and they are all essential.

This is a thought that you might carry home—that the draft boards do not know which men are essential on a railroad, or, at least, very few of them do.

New Sources Needed

E. H. Barnhart (B. & O.): I was particularly impressed with Mr. Chinn's comments. This year so far, we have employed boys, both Negro and white women, school teachers and manual training teachers. We have also contracted a certain amount of work, and have pretty well covered the 14 points mentioned by Mr. Howard—but still we are short of help.

I would like to emphasize to some extent Mr. Chinn's remarks, stating that we must look to some new source for this labor. Two sources have been mentioned: Mexican labor and prisoners of war. If we are going to get this labor, they will have to cut the red tape now involved.

Mr. Fitch: The manner of getting Mexican laborers is not so much a matter of red tape as it is getting the authority to use them. Concerning the Mexicans, it is also a matter of satisfying the Mexican government that the complaints they have made will be met or that the complaints are not well founded; and in this connection, I think we have done just about all that is humanly possible. We have even gone to the extent of enlisting Director Eastman's help, and he, in turn, wrote Mr. Stettinius, who has intervened personally in an attempt to settle the differences with the Mexican government. I know that there are enough influential men working on this problem to settle it if that is possible. But red tape comes after the authority is granted; when the recruiting is being done, and you have to cut your hiring cloth to the requirements of the Mexicans. Right now, it is a matter of trying to get authority to recruit more, and of retaining those we have.

Concerning prisoners of war, the thing that is holding this up is not the matter of going through the mechanics of asking for and getting them; it is getting the approval of the people who have the authority—at the present moment largely the War Manpower Commission—to permit the red tape to unfold. There again, we have been on the job just as diligently as possible to get the issue settled. If there is anything else we can do

to enlist the help of other interested persons, we will be glad to do it, but we think we have explored that angle pretty thoroughly and are following it up just as closely as we can.

I was impressed by the statement made by one of the men here concerning his disappointment over not obtaining some suggestions that would permit him to solve his labor problem immediately. That just is not possible. I am not a bridge and building man; in a sense, I am an outsider, even though I have been in the railroad labor game for quite a long time—but if I had some tricks up my sleeves I would tell you of them. The fact is, and we might as well face it, that the labor shortage is going to be a chronic difficulty until this war is over, and we are not going to be able to figure out ways in Washington—nor can you on the road—which, by a wave of a wand, will suddenly enlarge your gangs to double the size they were before. The best we can do at meetings like this—and when I say the best, I do not mean to minimize that, because I think the best is very important, and by and large, it is going to pull us through—is to compare our experiences and see how we can best adapt ourselves to a shortage situation which we cannot eliminate. We in Washington will tell you what we can about adaptations and interventions, and of any help we can get from federal agencies. We might as well realize that we cannot eliminate the shortage and see how far we can reduce its effects. When we have done this, we have done our duty for the duration of this war. We cannot produce men and women to work where there are none. All we can do is try to distribute our available manpower and work it in such a way as to get the maximum use from it. If we do that, even though it will not be entirely satisfactory, the railroads are going to continue to perform the essential service that is required of them by the war.

E. H. Barnhart: Probably I used the wrong word in saying "red tape." What I had in mind particularly was the ease with which we secured labor from Mexico during the last war. Perhaps I am thinking too far back and cannot understand why these laborers are not secured as easily now.

Increase Efficiency

President Crites: There is one thought I would like you to take home with you, and that is concerning the foreman's abilities. In 1918 and again in 1920, I tapped the Maryland House of Correction for short-term prisoners. I split the prisoners into groups of 12 with a guard over them and put a foreman in charge. One of these groups had an efficiency of about 3 per cent, where we consider 66 per cent as the normal efficiency of a man on track work. Another group, consisting of a foreman and exactly the same number of laborers, and under exactly the same conditions, had an efficiency of more than 80 per cent.

Conditions are changing, and it may be that we will have to look to see whether our foremen's ideas are changing—whether they are doing their work in an efficient manner. There may be a chance to improve performance in this manner. If the foreman of the gang

that performed with only 3 per cent efficiency had raised the efficiency of his gang up to 83, he would have accomplished considerably more work. As it was, he accomplished practically nothing. It is possible that such a condition may obtain in some of our bridge and building gangs. I do not know if it does, and I hope it does not, but there may be a possiblity there for increasing production.

Elmer T. Howson (Ry. Engr. & Mtce.): There is one thing, Mr. President, that has impressed me as I have gotten out on the various railroads, and that is the wide variation in the results secured on different roads and the equally wide variation between the results secured on individual divisions or portions of divisions on the same road. I think that it is a reflection, in part, of conditions, but it is also partly a reflection of the ingenuity of the officer who sets out definitely to solve his problems.

No Mass Solution

There is no mass solution, but there are individual solutions—working out a few here and a few there. The discussion this afternoon has shown that when we are employing women, we need certain differences of technique. That has been true also when employing boys. I know of two roads, both of which set out about the same time to employ boys. Orders went out from the general headquarters not only authorizing but instructing their men to recruit boys. They told them to go to the high schools. One road made a great success of the project. You heard Mr. Powrie tell about that. Another road in much the same general area had almost complete lack of success. The chief engineer of that road told me that, with the exception of one roadmaster, he got nowhere in the employment of boys.

I think the difference was in technique and in interest, and I think this labor problem, in its intensity, is in many respects a new problem now, and that we need to approach it from a new point of view to find out what will work. Even then we probably will not get all the labor we need, but we will get more than the fellow next to us who does not give the subject the proper attention.

This labor problem—our No. 1 problem—is a challenge to every supervisory officer to try to solve it within the limits of his own territory. He must solve his problem himself, and I think the various roads must solve theirs in the same way. It is largely the alert men of the type that are in this room that are leading in the solution of this problem. The fellow who thinks he gains nothing from meetings such as this is the fellow who stays home. He is the fellow who is most likely to have labor problems.

There are techniques that will work in part and some of them have been touched upon here. But above all, there is the new approach to this problem, the new challenge to try those things that we think will work and see what results are obtained.

N. D. Howard (Ry. Engr. & Mtce.): I want to suggest a thought that has not been brought out, and that is the attitude of defeatism, shown by a few maintenance men. It certainly does not apply to maintenance men as a whole, but there is a certain

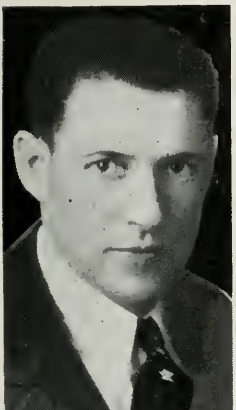
amount of defeatism among many on this labor problem. Certainly, with that attitude—that "we should let nature take its course; we have done everything we can," —this problem of securing adequate labor cannot be solved in the maintenance of way or any other department.

I am prompted in part to make this comment by what Mr. Norris, president of the Southern Railway System, said last Monday night before the Western Railway Club. After recounting the postwar difficulties that will confront the railroads as he saw them—and he lined them up until, as he admitted, they looked almost insurmountable—he based his confidence in the ability of the railways to meet their postwar problems entirely on the exercise of imagination, courage and initiative. I cannot help but think that we will not get to those postwar problems unless we apply such an attitude toward our present war problem. We must use the methods at hand to secure the labor that is necessary, using every bit of initiative that we can muster. As Mr. Chinn said, the situation does not look very encouraging, but bridge and building men certainly cannot afford to be discouraged by it.

Materials—Possibility of Relief Through Substitutes

Report of Committee

W. A. Sweet, (*chairman*), general foreman bridges and buildings, A. T. & S. F., Newton, Kan.; H. M. Church (*vice-chairman*), general supervisor bridges and buildings, C. & O., Richmond Va.; W. L. Anderson, (*vice-chairman*), office engineer, C. & N. W., Chicago; L. E. Peyser (*vice-chairman*), principal assistant architect, S. P., San Francisco, Cal.; F. W. Dayton, architectural draftsman, C. & N. W., Chicago; H. M. Dick, master carpenter, Penna., Toledo, Ohio; A. G. Dorland, assistant engineer, E. J. & E., Joliet, Ill.; A. W. Glander, chief carpenter, C. M. St. P. & P., Mason City, Ia.; F. W. Hutcheson, assistant supervisor, bridges and buildings, C. & O., Newport News, Va.; F. H. Masters, chief engineer, E. J. & E., Joliet, Ill.; and B. M. Whitehouse, general bridge inspector C. & N. W., Chicago.



W. A. Sweet
Chairman

The preparation of a report on the substitution of materials is particularly difficult at this time, because of the confusion now prevailing throughout the entire category of materials. The conditions are changing so rapidly, almost from day to day, that a material that is available in quantity today may become "critical" and unavailable overnight, thus forcing the substitution of another material which in turn may be impossible to obtain.

This situation has now reached the point where possibly the first consideration given to substitution should be the use of second hand material, where it can be made available. A careful survey of abandoned or partially-occupied buildings will bring to light an amazing amount of salvable materials that are not otherwise available. In other words, the old New England adage is morethan normally applicable under the present circumstances: "Make it do; wear it out; do without." We are forced to this unless substitutes are found.

The national war effort has brought about a serious restriction of building materials in general use on the railroads. Mention may be made especially of all types of metal and kindred products; lumber, bituminous products, lead and oil paints, reinforced concrete products, etc.

Buildings

Through very careful study and analysis of each project, certain critical materials can be eliminated and non-critical materials substituted for them; in many cases, at very little extra cost. In other cases, it may not be practicable to eliminate critical materials entirely, but they should be held to a minimum through careful planning.

Probably the most widely used

building material on the railroads is lumber; it was readily obtainable, and bridge and building men were adept in using it. But lumber is now on the critical list and other materials can take its place, to a great extent.

The exterior walls of buildings may be constructed of brick, structural tile, or other similar products that are not on the critical list. Masonry block units make very satisfactory exterior, as well as interior, walls, although when they are used as exterior walls, it is best to apply stucco or some other water-repellant coating, especially when the inside surface is to be plastered directly on the units. The use of stucco on masonry units not only serves as a waterproofing agent, but gives a very pleasing appearance and is very elastic in design. Stucco can be purchased in various colors, already mixed, or it can be mixed on the job. Various kinds of structural building tiles and bricks are also available, which are enamelled on both faces, thus presenting a pleasing appearance on the exterior, as well as the interior, without any further treatment of either side of the wall.

While not to be classified as a substitute, corrugated asbestos also has a wide range of uses. It may be employed for siding, where corrugated galvanized steel would ordinarily be used; however, the supporting framework must be heavier, and a much better job is obtained. Corrugated asbestos has been used widely on roofs, especially on warehouses, machine shops, power houses, etc., where conservation of heat is not a vital consideration. This material is also used for interior partition walls, although usually not corrugated.

Probably the best substitutes for wood sheeting on frame walls are the various types of fiber board. Such materials have been used for many years and have proved very satisfactory. They can be used on interior walls as a substitute for lath and plaster; or can be used as a plaster base. Panel board ceilings of these materials can be employed in many pleasing designs. When applied to exterior walls, a finish covering must be added, such as wood siding, brick veneer, or similar construction. Fiber board can be obtained with a mineral-surfaced asphalt coating, fabricated to imitate brick siding; this material can be applied directly to the framework of exterior walls, forming a weatherproof surface.

Decorative cement-asbestos materials can be used to good advantage on interior walls as coverings for obsolete wood wainscot and beaded ceiling prevalent in many of the older station buildings. These materials can be obtained in large sheets 1/8 in. thick, and in several colors—including green, tan, rose and black. They are very well suited for remodeling work.

Wood flooring has been the most common construction for many years. However, lumber is now on the critical list and there are a number of very good substitutes. Asphalt tile is an excellent material; it can be applied over wood floors as well as concrete; bridge and building men are becoming familiar with its application and can do a satisfactory job of laying it. The tiles come in a wide range of colors and are suited for use in offices and station waiting rooms. Various types of mastic floor materials are also available which can be applied directly to wood floors; however, many of them require wire mesh nailed to the existing floor; of course, this is not necessary where they are laid over concrete floors.

Since metal lath is on the critical list and no longer available for plaster work, a very suitable substitute is gyp-

sum rock-lath. In many cities, it is given the same fire-resisting rating as plastering with metal lath. This material is also made with a bevelled edge; the joint is filled with a cementing compound and paper strips are cemented thereon, thereby concealing the joints and forming a surface suitable for painting. Such construction is less liable to show cracks than metal lath and plaster work.

Steel sash are on the critical materials list and are no longer available. As substitutes therefor, careful consideration should be given to the relative merits of wood sash and glass blocks. Windows may be of the fixed type with a ventilating panel, similar to steel sash construction except that they are of wood, including frames and muntins; thus they eliminate sash weights and cords, pulleys, and weight boxes. It is not always practicable to use wood sash in large openings because of the large mullions, muntins, and rails that are necessary, and that reduce the amount of natural light admitted.

Use of Glass Block

In many cases, glass blocks can be used to good advantage. The modern trend in architecture is to use glass wherever practicable. There are a variety of uses to which glass may be put, including decorative panels, fixtures, wall surfaces, interior non-bearing partitions, etc. Glass blocks may be used in interior non-bearing partitions in lieu of wood framing, plaster and painting. They may be used in enginehouses, machine shops, and other railway buildings in lieu of wood or metal sash. They are not affected by gases or other corrosive agents, and provide a more even distribution of light than the ordinary window. The heat loss through glass block construction is about half that of an ordinary window; thus saving considerable expense of heating. Very little maintenance is required, and where blocks are broken, replacement is simple. Although the initial cost of glass block construction is somewhat more than window construction, the additional cost will be saved over a period of time and the salvage value is about one hundred per cent.

It has been the custom in the past to construct steel lintels for window, door, and other openings in masonry walls. As this material is now critical, substitutions can be made in part at least. For structures of hollow building blocks, the hollow spaces in the proper number of blocks to span the opening, can be filled with concrete and a few reinforcing bars, thereby forming an excellent lintel with the use of very little critical material. For lintels in brick walls, or other solid

An Example of the Use of a Non-Critical Material Is This Oil House with Asbestos-Cement Roofing and Siding

masonry construction, a wooden beam of the proper size to carry the load, with an angle attached to carry the exterior course of brick, is suitable; often usable timbers and usable steel angles are available.

Heretofore, copper, sheet metal, and wrought iron pipes have been used for gutters and down spouts respectively on various types of buildings. These are all very critical materials and substitutes are available. Wood gutters are on the market in finished condition and their use does not detract from the appearance of the structure; wood down spouting can also be constructed. These, of course, should be replaced when metal is again available. In some cases, scrap boiler tubes have been used for down spouting.

Copper and sheet metal have long been used for flashing. Much of these metals can be eliminated by using the same materials that are used for the roofing—particularly with flat-pitch built-up roofs. Asphalt-impregnated cotton fabrics make excellent flashings, but the cotton is more critical than the felts.

Hot air heating ducts, when not underground, have always been constructed of sheet metal. They may be constructed of cement-asbestos board, which is not critical material, and the cost is not excessive when compared with sheet metal construction.

The restrictions on hardware are rigid and the simplification of the requirements is essential, as there is no substitute. Consideration should be given to the necessity for complete lock-sets on every door; it may be possible to eliminate a number by using simple latches or bolts. Glass push-plates can be substituted for metal, and hardwood push-bars for metal. The necessity for door checks should be analyzed carefully.

In larger structures that require the use of trusses, wood trusses should be considered in order to conserve the more critical materials. Wood trusses can be purchased already fabricated, or they can be built in the field. Many ingenious designs have been prepared for such trusses and they are being used more and more as a permanent substitute for steel.

Sanitary and Locker Facilities

Many of the larger plumbing concerns have prepared catalogues showing the various sanitary fixtures that may be purchased, conforming to Government regulations. It has been recognized that such fixtures are necessary, but the brass, nickel, and chromium metal fittings have been eliminated and cast iron substituted.

Metal partitions are no longer available for toilet and shower stalls; this applies also to metal lockers. A suitable substitute for toilet and shower stalls, is plywood, which is also critical but not to the extent of metal. Lockers are also constructed of plywood; however, consideration should be given to the places where they are to be used, as it is not desirable to use plywood in enginehouses, machine shops, or enginemen's locker rooms, for the service in such locations is very detrimental to such lockers.

Water Service

Most of the materials that it is possible to use as substitutes in water service are critical to a greater or lesser extent. Therefore, the solution of the problem here is to make only those installations and renewals that are imperative, and to use materials lower down in the critical list than ordinarily applied; viz: substitute steel for copper; timber for steel; concrete for timber, and composition and pulp

products for rubber. Economy must not now be allowed to influence the choice of materials. In many regions, labor is critical and it may be more helpful to the war effort to use a more critical material, if by so doing a substantial saving in man hours can be effected.

Copper is among the most critical water supply materials. Wrought iron pipe swabbed with asphaltum or encased in concrete can be used in place of copper pipe where soils are highly corrosive. Brass clamps and ground wires for electrical connections should be utilized to reduce copper requirements. Substitutes for copper and rubber gaskets are felted asbestos, putty, cardboard, roofing paper, and white lead on canvas.

As large quantities of pipe are used annually by the water service personnel, much thought should be given to finding suitable substitutes for critical materials. Asbestos cement pipe, used by some railroads even prior to the present shortage in iron and steel pipe, is acceptable and economical in certain cases, such as a long run where there are few turns or take-offs; cast iron fittings are required at such locations, as well as concrete thrust blocks. Rubber rings, held in place by asbestos couplings, seal the joints securely, even in installations subject to vibration from passing trains. This pipe is not recommended where excessive "water hammer" can be expected, such as in penstock service lines. It is manufactured in four grades, to carry pressures ranging from 50 to 200 lb., and from 3 in. to 36 in. in diameter; it comes in 13 ft. and 6 ft. 6 in. lengths.

Both wood stave and reinforced concrete pipe require some steel for reinforcement, but the saving in metal justifies their use during the emergency. Vitrified pipe, encased in concrete, can be used in some instances. The recently-developed plastic pipe, in the smaller sizes, has possibilities; it is light in weight; yet tough, durable, and resists corrosion. It can be threaded with standard pipe dies or welded with a blow-torch at a temperature of about 400 deg. Its high cost and inability to withstand temperatures much above 175 deg. must be overcome before it can take the place of steel pipe.

The welding of joints in steel pipe is an excellent substitute for couplings, bolts, and gaskets. Likewise, the repair of leaking pipes, or broken and damaged equipment of all kinds, by welding makes new materials unnecessary, as well as saving man-hours over making new installations.

Reinforced concrete and treated timber water tanks, using comparatively smaller amounts of steel, are common substitutes for steel tanks and towers. Pile sub-structures are being used frequently in place of steel sub-structures for wooden water tubs.

Bridges

In bridge maintenance, several different types of construction are employed to conserve critical materials. Frame bents may be constructed with pipes, and caps may be built up by using two or three smaller timbers, fastened securely with bolts and metal connectors. Helper posts and stringers can often be added to a pile bridge structure, and thus defer heavy renewals for several years. Pile bents can be double-capped, and additional piles driven to extend the life of the structure for some time.

Pile structures requiring out-of-face renewal may be replaced with concrete pipe, concrete boxes with covers reinforced with scrap rail or wood box culverts constructed with usable material. However, careful

study should be given to the provision of adequate waterway. When it is necessary or advisable to construct a wood box culvert as a temporary expedient, it should be built of usable materials and large enough to permit the installation of a permanent culvert inside when it becomes necessary.

With steel structures, it is possible to make lasting repairs by the use of second hand materials that are usually to be found at the railroad's reclamation plant. It is also practical, although somewhat of a temporary nature, to provide adequate bracing, or strutting, by the use of oak timbers; this should only be done under the jurisdiction of the bridge engineer.

Petroleum products, such as bituminous concrete, cut-back asphalts, and asphalt base paints, are restricted and can only be obtained under high priorities. Bituminous concrete and cut-back asphalts were widely used for station platforms, shop walkways, etc. Substitutions can be made with stone screenings, brick, or concrete and also, by a natural rock asphalt, which is not restricted; however, the use of this latter material is prohibitive for railroads located some distance from the source of supply.

Lead and oil paints are somewhat restricted, but can be obtained under proper priorities. It is recognized that paints are essential to the proper maintenance of structures. However, for interior work, there are a number of substitutes for oil paints and these should be used wherever possible. Cold water paints can be obtained in many colors and they are being used more widely, following recent developments in the better grades.

The general outlook, at present, is that all materials will become more difficult to obtain. Therefore, it behooves all of us to plan carefully, eliminating all critical materials possible, and maintain close supervision.

. . . For the general discussion which took place on the material situation, see page 91.

What Can We Expect in Materials?

By Albert C. Mann

Vice-President, Purchases and Stores, Illinois Central, Chicago

(Introduced by Past-President Elmer T. Howson)

A. C. Mann
Chairman

Elmer T. Howson: It is a privilege to present the next speaker. The man whom we are about to hear is a pinch-hitter and we are deeply obligated to him for this reason. Only day before yesterday we learned that a representative of the Office of Defense Transportation, who was to have been with us to talk on materials, could not be present. Albert C. Mann, who will talk to us, has been known to this association for many years, and when we were in need of a specialist on materials, we turned to him more or less instinctively because of his reputation. Mr. Mann is in charge of purchases as vice-president of the Illinois Central. He is coming before us this morning to open up this broad problem of materials, which has been the No. 1 problem among bridge, building and water service officers, and is relegated to the No. 2 problem,, if it is relegated to that, only by the tremendously serious shortage of labor. If we had the labor we need, materials would still be our No. 1 problem.

Mr. Mann is going to bring us some helpful suggestions as he sees them, not only from a system point of view, but from a national point of view as well, because he knows the national point of view as do few other purchasing and supply officers. Albert C. Mann, vice-president of the Illinois Central System.

Address by Mr. Mann

About the first of the present year, the Office of Defense Transportation was named the claimant agency for the transportation industry, which includes not only the railroads, but all other forms of transportation. Prior to that time, there was no set regulation, except that the War Production Board would ask the Association of American Railroads what the railroads would need in the way of critical materials over a certain period of time. Following a lot of figuring, some distribution of these materials was then made.

The War Production Board had been experimenting during the last two years with various methods of arriving at a basis for the proper distribution of critical materials, and finally, beginning in the second

quarter of this year, it established what is called the Controlled Materials Plan, which is now in effect. We in the railroad industry who have to do with materials feel that this is the best plan that has been proposed thus far. It is working, although we hear rumors that there may be changes in it. We like it because it gives us rather positive assurance that those materials which are allocated to us in a certain quarter will be received during that quarter, or within the early part of the following quarter.

Some of the regulations embodied in the original plan have been eased to the extent that we are now being asked, and, in fact, are being urged, to put orders on the books for steel and other critical materials as far ahead as the third quarter of 1944, on the assumption that by the time we get around to those quarters, allocations will have been made and authority issued to distribute the material ordered. I don't need to tell you that in looking at your needs as far as a year in advance, one must have something better than a crystal ball to gaze into—that he must have considerable leeway in his plans, to the extent that he can make changes as conditions arise. The War Production Board recognizes that, and says it will permit changes in actual orders placed, provided the total tonnage or the dollars and cents quota which has been allotted is not exceeded.

Those in charge of materials started out on the theory that they were going to control the inventories in this country so that vital, critical materials would not be lying around idle—a lot in one place and none in others. We haven't quite succeeded in selling the War Production Board on the fact that a railroad inventory cannot be considered the same as an industrial inventory, although we are coming closer to that all the time. The original plan was to pin us down to a 60-day inventory, and the rule to that effect has not been withdrawn. However, recognizing our position in this matter, the Board is not showing undue concern if our inventory covers 90 day's needs or a little more than that. With regard to bridge timbers, crossties and items of that character, which must be seasoned before treatment, we have succeeded in securing at least a verbal understanding to the effect that a six to eight month's inventory will not be criticized.

The War Production Board is staffed with men who understand, or who are at least learning to understand, the railroads' problem. The men who pass on our quarterly statements have an understanding of what those statements mean, and the importance of materials to the railroads, and while we have not yet gotten the railroad industry, as an industry, out of what is called Civilian Supply, and over into National Defense, where it belongs, we are securing the kind of help from Washington that we prayed for and worked for.

The transportation industry is about eighth or ninth on the list in the distribution of materials. The Army, the Navy, the Air Force, the Maritime Commission, Lend-Lease and rehabilitation bureaus in foreign countries all come ahead of the railroads as regards critical materials, but we are securing understanding consideration on the

part of the people in Washington when we present our needs to them properly.

Confusion Clearing Up

Some of the greatest confusion that the railroads have faced in the matter of materials since we entered the war has been due to the fact that they were told from the start that they could have the materials they needed for maintenance, repair and operation, but that before they could make any improvements—make any changes in existing structures that would make them different than before—they would have to secure special authority from Washington—that they could not use materials secured on regular orders for work of that kind. It took a long time for many of us on the railroads to understand that we could not use material in stock for improvements unless we secured a special project authorization from Washington to do so. If the word in this regard has now been passed down by the heads of the engineering, maintenance and purchasing departments, all of whom now understand the situation fully, past confusion in this matter should be eliminated in the future. When we ask Washington for materials, we must be certain that they are used only for the purpose for which they have been requested.

Lumber and Steel

Lumber, in which you men in the bridge and building department are particularly interested, may cause us trouble for some time, although I understand that the timber situation on the West Coast has eased up to some extent. In view of this, and with a proper understanding of what their lumber inventory is, I feel that the War Production Board office in Portland will help the railroads get the timber that they need.

The board is not willing for you to build up an unusual supply. There is going to be a tremendous demand in all the lumber-producing territories for boards to be used for crating and blocking in connection with military shipments. So we are going to be up against it for lumber for at least another year, although certain situations may be eased within that period.

There are certain grades of steel that are becoming a little easier. Whether they will stay that way, we do not know. Six months ago, we could not get alloy steels. That situation has eased up considerably and we are now being asked if we can use alloy steel in some places instead of carbon steel, because the latter is vitally needed in the country's shipbuilding program.

These changes occur and we don't know what they are going to be until they happen. A thing that is critical today may be easy tomorrow, and just the opposite. So it behooves those in all departments of the railways to keep in close touch with those on their roads whose responsibility it is to keep abreast of the changing material situation.

DISCUSSION

President Crites: You have heard these very interesting comments from a man who knows the subject. I am sure many of you have questions to ask.

R. E. Dove: (C.M.St.P. & P.): I would like to ask Mr. Mann to explain further his remark about steel being allocated on a tonnage basis and then qualifying it by reference to a dollars and cents basis.

Mr. Mann: There are certain items on the report, Form 2585, that we have to fill out our quarterly requirements on each railroad, a lot of which call for allocations in tons. Practically all steel items are in tons. Track material—I believe tie plates and angle bars, are in tons: bolts, spikes, nut locks and things of that kind — are grouped, and you are given a dollars and cents quota on them. In other words, each column tells you your quota, whether you express it in dollars or tons. Many miscellaneous building materials—lumber, for instance—are now included under dollars and cents, not board feet. So it is just a matter of how they ask you to handle it. The purchasing department has to submit that report and they have to get the information for it from the outside storekeepers or the using departments.

L. C. Winkelhaus (C. & N. W.): You mentioned something about using materials that you find in stock, or that you might have in stock. Did you mean railroad stocks or stock in supply houses?

Mr. Mann: Railroad stocks. In other words, if you have ordered it for repairs, you violate the law if you use it to build a new bridge.

Mr. Winkelhaus: Suppose you could get some of this material out of supply houses, where they have it in stock?

Mr. Mann: That is all right. You have a perfect right to do that, provided you do not exceed the allotment that has been given you from Washington, either in dollars and cents or in tons.

Restrictions on Road Oils

W. A. Huckstep: (M.P.): Mr. Mann, in the report just preceding your address, one of the first items mentioned was petroleum products. Just recently, the restriction was taken off of all except certain classes of road oil, which now permits the use of pre-coated aggregates for surfacing platforms, runways, etc. Since the time this report was edited, that change has been made.

Mr. Mann: Yes, there has been some relief. I noticed, as I went through reports this morning, that we are able to get asphalt mixtures for road crossings and platforms a little more freely than we could some time ago, and without filing some of the reports we used to have to file.

Mr. Huckstep: What method is used on your road to notify the men using materials in the various departments when restrictions are put on or are released?

Mr. Mann: We have a plan on our railroad whereby a man designated by the chief engineer and another man designated by the mechanical department sit down with a bureau organized in the purchasing department, every time releases affecting the various departments are received. We depend on these men to get the information to their organizations.

Mr. Huckstep: In other words,

you do not circularize this information.

Mr. Mann: Not unless the informal committee decides that is the thing to do. We do circularize information concerning the necessity for watching requisitions when placing orders to see that they conform to regulations.

Mr. Huckstep: In my department, we receive the Federal register and we depend largely on that. In fact, we get our information much more quickly that way, by checking each day as issues come in.

Mr. Mann: I think each of our using departments are subscribers to the Federal register, too. We very often get information from it before it comes through from the War Production Board.

J. S. Hancock (D.T.&I.): Frequently, we have high water in the spring and then we need additional piling and bridge timber. As I see it, the only way we can secure these needs is to include some material for that use in our quarterly allocation requests. What else can we do?

Emergency Requests

Mr. Mann: You can always make an emergency request on Washington. If you need additional materials because you have a bridge burn up, or because of high water conditions, and your quota is already used up, you can always file a supplement request and the chances are you will get your request.

Mr. Hancock: How long does that take?

Mr. Mann: Not very long. Six months ago, it might have taken six or eight weeks, but they are doing much better now. We had a situation on our railroad where we had to rebuild a trestle, 1172 ft. long, that had burned. It did not take long to get authority to use material out of stock to replace this bridge. Of course, you should protect yourself to take care of a few emergencies.

Elmer T. Howson (Ry. Eng. & Mtce.): Then, really, Mr. Mann, what you ask for is authority to replace your present stock.

Mr. Mann: That is right, Tell them the reason for it, what happened. You must replace your stock, because with a structure of the kind I mentioned, if you had to rebuild it right away, you would deplete your protective stock entirely.

J. P. Hanley (I. C.): Mr. Mann, you stated that the heavy timber situation, particularly on the West Coast, was improving. In the water service department of the Illinois Central, we are interested in 100,000-gal. capacity creosoted pine water tanks, and it takes about three months or longer to purchase, season, dry and prepare for use the material for these tanks. I wonder if you can tell us the prospects for the wood used in these tanks.

Mr. Mann: That material is of a size that is pretty hard to get today on account of the demands of the government. It comes within a size range that is being purchased heavily by the Army and Navy. We just have to think ahead and pick up a little as we go. Of course, on

our railroad, we try to keep at least one tank ahead if we can. However, we do not always succeed in doing that.

Mr. Howson: Mr. Mann, judging from your comments, you feel that we can look to the future with some degree of optimism. In other words, conditions are improving, both as to the routine of procuring the materials and as to the supplies actually available.

Mr. Mann: More on the first than on the second point. I am not entirely optimistic about the material situation for next year. I think it is easier, yes, but I would not shout about it from the housetops.

Mr. Hancock: Last year when we asked for steel to replace timber trestles, the piling of which was entirely inadequate to withstand high water conditions, we were turned down because it was a case of using steel to replace timber. We have more of this work that should be done this year, but after our previous experience, we do not feel encouraged to try to get the necessary steel. We will no doubt be turned down, and we do not know how much longer we can carry these structures.

Mr. Mann: I would keep on asking for it. If you can prove that it is time to change out a wood bridge with a steel bridge because of wear and tear and increased traffic, you will get your request. In other words, you must have a story and sell it.

President Crites: Mr. Mann, I am personally very gratified and pleased that you could be here, and, on behalf of the American Railway Bridge and Building Association, I want to express our appreciation.

(For a further discussion of the materials problem, see page 91.

Material Problem—As Seen By A Bridge Man

By A. M. Knowles

Engineer of Structures, Erie

During the last two years, bridge and building officers have learned much about federal control and regulation in the distribution of materials, and what they mean in the maintenance and construction of the railway facilities. We have become accustomed to priorities and preference ratings and their consequences. The shortage of labor, which is growing more acute daily, on top of the federal restrictions that are being imposed on the material supply, is forcing the greatest economy of both labor and materials at a time when the railroads are better able financially to expand their expenditures for needed improvements than ever before.

The absorption of enormous quantities of materials of every class in the war effort, together with the cream of the manpower of the country, has forced every bridge and building man to exercise extraordinary vigilance and to develop an added sense of responsibility to see that neither material nor labor is wasted, but rather is utilized to the fullest extent. At the same time, it is self-evident that the facilities under the care of bridge and building men represent the foundation upon which the entire railroad plant rests. Any failure in these facilities will result in delay, loss, and sometimes disaster, and to that extent will hinder the important part the railroads are playing in the war effort.

Use On-Hand Materials

It is of no avail to wish for materials or men which we cannot have. We must make the most of what we have and exercise all the ingenuity, resourcefulness and courage we can muster to this end, and also encourage these qualities in others all the way down the line, to enable us to cope with the situation and attain the essential results. The conservation and fullest utilization of materials on hand is one of the first steps in attaining these essential results. If the required materials are not already on hand and cannot be procured from other departments, satisfactory used materials may frequently be purchased without priority assistance. While it might not be considered economical under ordinary conditions to work over and reuse secondhand materials, as a war measure it is quite the thing to do, regardless of the economy phase. Frequently, as much economy and as satisfactory results are secured from such usage as would be the case if all new materials were used.

On the Erie we have made use of entire second-hand girder spans that had been released previously

for various reasons—spans that, as constructed originally, were too light for present-day power. This has been done either by reducing their length or by reinforcing their parts. For some of the reinforcing for such spans, second-hand material can be used, but in other instances new material is necessary. Many steel bridge repairs can also be made with second-hand material. Besides reworking released bridges for reuse, we have, while making repairs to existing bridges, reinforced many of them in service. New material is usually necessary for such work. We have found considerable advantage in the use of second-hand beams for grillages in bridge seats, to prolong the life of old abutments that were beginning to fail under the bearings. The beams used in these cases are long enough to distribute the girder or truss loads over a larger area of the abutment than the original bridge bearings, which were designed for lighter locomotives than those now in use.

Bridge and building officers have always foreseen their needs for materials and supplies well in advance of their usage, but because of the present shortages in many items, major operations, at least, must be foreseen even earlier than heretofore. This is necessary to avoid risks of delays or of being prevented from undertaking work entirely because of failure to have on hand the necessary materials and equipment.

Train New Employees

The effect of the shortage of experienced maintenance forces is next in importance to the shortage of materials and equipment. With the constant drain of experienced men to the armed forces and war industries, resort must be made to filling in our forces with new recruits who must be trained for the particular work they are expected to do. Many of these new recruits are unaccustomed to the inconveniences and hardships they must undergo, and it is more difficult to retain them in the service than it has been to hold the men of an earlier generation, who began their railroad careers when there were an ample supply of labor and fewer attractions in other kinds of work.

As a consequence, camp cars or other facilities housing bridge and building crews located away from their homes for weeks at a time should be provided with better living conditions and greater conveniences than in the past to make them more attractive to the class of men now available for this type of work. This has been done to a large extent on the Erie, and more improvements of this nature are under way.

The Erie management, realizing the need for and the advantages inherent in systematic training of its new employees, and of improving the status of older employees under present circumstances, as well as the need for a definite technique to be followed in providing such training by key men or supervisors, has established an educational department under a director who devotes his entire time to carrying out a continuous training program. This applies to all departments of the railroad, including the bridge and building department.

The director, taking small groups of the heads of departments and

their assistants at a time, gives them the necessary instruction and training to enable them, in turn, to become instructors of groups under their jurisdiction. They are taught the principles of salesmanship, job-instructor and job-method training, how to encourage and maintain enthusiasm, and how to settle grievances.

The job-instructor-training course is designed to teach the best way to get a man to do a job safely, correctly, quickly and conscientiously. This has been very helpful in getting across to supervisors and foremen the fundamental principles and methods of training men. The job-methods-training course, on the other hand, is designed to give one a practical, organized plan to improve job methods, to produce more and better products or services in a given time, with no harder work, and to make the best use of machines, materials and the abilities of those people now available. This course has stimulated the heads of departments, supervisors and foremen to study many phases of work under their supervision and to suggest improvements, with the result that many new and worth while ideas are being adopted and put into use.

For the general discussion which took place on the material situation, see page 91.

Material Situation—What Building Men Can Do About It

By A. L. Sparks

Architect, M-K-T Lines, St. Louis, Mo.

A. L. Sparks

We are all anxious to learn of new methods and materials with which we can add to and maintain our over-taxed facilities without resorting to the use of critical materials, or to the use of labor needed for the making of ships and planes and guns. There are many things that we can do in this regard.

First, we can exert every effort to help win the war in the shortest possible time. Second, we can help keep transportation rolling, and at the same time strive to keep the facilities from running down until they are no longer usable, or to the extent that we will not be able to catch up with the burdensome maintenance for many years after the war.

Some Construction Necessary

Some new building construction is necessary. For example, a coaling station, a sand plant, a water service plant or other service building may burn down and, unless replaced, transportation may be crippled. However, in such new construction, non-critical materials should be used so far as possible.

We should familiarize ourselves thoroughly with War Production Board's Conservation Order L41, with all of its revisions and interpretations, and we should also familiarize ourselves with the bulletin on Critical Construction Materials. We should give thorough consideration to our preliminary studies, plans and estimates, being sure there will be no change in our designs and lists of materials that will necessitate resubmitting them to the WPB after authority has been once given.

In recent weeks, much has been said about the shortage of packing cases and cartons in which to ship ammunition and supplies. This need has expanded the demand for wood to include species not heretofore on the restricted list, so that today all lumber is critical and wood of any kind is scarce.

All metal remains highly critical, although there has been some loosening up on small quantities of pipe, reinforcing steel and copper wire, and a general release on nails. This does not mean that we can purchase these things when and where we please, and in as large quantities as we desire, for the demand is still larger than the supply, and probably will be for the

duration and sometime thereafter on account of the shortage of labor for producing, processing and distributing them. A certain amount of wood is necessary in almost all kinds of building construction, but there is generally a considerable amount of second-hand lumber available which can be used for building forms and for rough framing. Also, ready-built form units of steel can be rented from contractors in larger cities.

Certain types of structures may be constructed almost entirely with non-critical materials. For example, small shop buildings can be constructed with plain concrete or rubble stone foundations, concrete floors on earth fill, concrete roof slabs on old rail beams, roofs covered with pitch and gravel, walls and partitions of brick or tile, plastered, and the principal windows can be built of hollow glass blocks.

Plumbing, electric lighting, heating and ventilating materials are highly critical, and doors and millwork are somewhat restricted. Therefore, all of these should be used as sparingly as possible.

Much Maintenance Can Be Done

With non-critical materials, much maintenance work can be done now to keep structures usable and to avert postponement until our work programs are overcrowded and funds are not available. We can help by catching up on repairs to concrete pavements, retaining walls, masonry foundations and sub-structures, the materials for which are non-critical. We can correct defects in drainage and sewer systems, heretofore crowded out by other construction projects. We can clean and rake the defective mortar joints in terra cotta, stone brick and masonry buildings; tuck point them and install new wall caps and copings; and calk around the windows and doors—all with non-critical materials.

We can repair and waterproof the weathering surfaces of expensive concrete structures to prolong the life of these structures. We can repair, reline,or rebuild defective chimneys with non-critical materials, and thus reduce the hazard of loss of buildings by fire.

We can substitute plain concrete gutters or walks around buildings for which we cannot secure the material to renew deteriorated metal gutters, and thereby protect the foundations from settlement and the sub-structures from decay. We can renew worn out and leaky roofs with new long life roofs, using non-critical materials, and thereby place those unavoidable expensive repairs behind us for many years to come. We can renew broken glass and repaint buildings and structures. We can clean the rust from some of our corroding steel structures and paint them or coat them with a rust-inhibitive material.

In addition to the strictly maintenance items, we can dismantle obsolete and abandoned structures and reduce the size of stations and other buildings where changed conditions have made such large buildings no long necessary; and the carefully salvaged materials can be used for the construction of new facilities or the repair of old ones. Furthermore, since house insulation is not critical, we help materially by insulating old buildings to reduce heat loss, and thereby conserve fuel. And in addition to all of this, every bit of dismantled

wood should be examined carefully and the usable portions salvaged, even to the shortest pieces which even be used for blocking. Short pieces of timbers can be resawed into boards useful for patching defective sheathing on roofs. Salvaged car lining can be run through planers and made into drop siding. A nail should never be broken off in a board or timber when it can be withdrawn, for it may be necessary, sometime, to rip or plane that board to fill a need where other material is not available.

For the general discussion which took place on the material situation, see page 91.

Material Situation—Water Service Men Can Do Much To Help

By E. M. Grime

Engineer Water Service, Northern Pacific

E. M. Grime

With the declaration of war, the responsibility of every maintenance of way officer became practically the same as if he were directly in the armed forces, and this is a continuing responsibility. Every water service officer must realize that his minimum requirements today are those necessary to keep the railroad operating at 100 per cent efficiency.

Unfortunately, the labor, material and equipment that are so vital to the provision and maintenance of railway water service must be drawn from the same reservoir as that directly supplying the armed forces, but since this is the case, any water service man who can conserve any or all of these elements, without detriment to good service, is rendering an important contribution to his country at this crucial time. With the demand for the highest quality of locomotive boiler water currently 200 per cent, and sometimes 300 per cent, greater than former normal requirements, conservation does not necessarily mean getting along with less than formerly, but rather that the greater quantities of material required be used more effectively than ever before.

Saving Materials Conserves Labor

A common railway slogan reads "Material is money, save it." Because practically all material or equipment used on a railroad involves the use of labor in its reduction from its natural state, in its manufacture or in its transportation, we may well, with particular timeliness, change this slogan to read "Material is labor, conserve it." In the conservation of material, therefore, labor is of prime importance because it is everywhere a vital element. This does not mean that some change can always be made which will reduce man-hours for a given performance. On the contrary, increased business means that more man-hours will be required, and hence a greater need for careful supervision to obtain maximum production and efficiency. Since the army has already drawn off a large part of our younger available men, we must get the ultimate from what is left if we are to keep performance to the required standard. This may necessitate a much greater use of labor-saving devices and the adoption of minor improvements that

have not heretofore been considered essential.

Early in the war, metals became critical, and lumber has since become almost as critical, so that water service improvements of any kind must now be able to justify themselves. Early in the war, water service construction was affected directly by a scarcity of cast iron pipe and fittings, and even of asbestos cement pipe and wood pipe, which in some instances might have been suitable for the same purposes. This situation has been helped greatly on some roads by preparing a list of all piping of various sizes remaining in the ground at abandoned water stations and in abandoned lines elsewhere. Whenever a new improvement is planned, the list is checked over and the required pipe, and often the necessary fittings are selected for excavation at the most convenient location, preferably on the same operating division. Some railroads have found 10 to 20 miles of cast iron pipe, practically as good as new when cleaned, available as a substitute for such critical material.

Here, of course, there is a labor item involved, but it has usually been found possible to get the work handled by a small contractor whose dragline or trenching machine is idle during the present lull in municipal construction work. In one case, several hundred feet of 12-in. wrought steel pipe was dragged from an abandoned river intake line and made available for deep-well casing.

The conservation of lumber for new buildings has been possible to a considerable extent by the substitution of concrete blocks, hollow tile or common brick. Small additions required at wayside water treating plants, or for additional chemical storage, can frequently be taken care of by using discarded box-car bodies. This may not add to the beauty of the premises, but it is a legimate war measure. Creosoted timber for the substructures of water tanks provides a good substitute for the more critical steel, and such timber substructures supporting a wooden tub are economical substitutes for complete steel storage tanks.

Cleaning Pipe Lines

The cleaning of certain existing pipe lines, where a higher pumping pressure is required than should normally exist, is another important item in the conservation of water service materials. One pipe line, two miles long, cleaned without serious interruption to pumping service, increased the capacity of the line from 233 to 341 g.p.m., or 46 per cent. As a result, it was possible to provide ample pumping capacity and also to get along with two pumping shifts where three would have been required otherwise. In another case, cleaning the tuberculation from an old discharge line only 1,100 ft. long, decreased the total dynamic head sufficiently to increase the pumping rate by 55 per cent. This made it unnecessary to purchase a larger capacity pump, which had been contemplated. These and other examples of measures which have accomplished savings in a similar way, show the desirability of investigating pumping pressures and capacities, particularly at places where the water demand has increased to such an extent that larger service lines and larger pumps are con-

templated. By these measures, the purchase of critical materials may often be postponed or avoided, with no resultant loss in service.

As the result of increased business and the necessity for moving it faster, increased flow at water columns is one of the urgent requirements at many places, In some cases, the laying of a larger supply main is the remedy, while in others, the rebuilding of the storage tank at a higher elevation gives the desired additional flow head. If the larger size of pipe is not available, sometimes the laying of an additional pipe parallel with the existing main, in some size that is available, will give the desired increase in delivery.

Pumps for Motors

In many cases, modernization of existing pumping equipment now becomes of paramount importance, even though critical materials must be made use of, because it is the only practical way to obtain the necessary increased water production. In some cases, it will be found that by replacing an obsolete type of triplex or duplex pump with a centrifugal pump of larger capacity, less weight of critical steel may be required than for the necessary repair parts for the old equipment. The expense may also be less and the efficiency of the operation improved.

Electric motors are now so critical that an inventory should be made of all surplus equipment of this kind on the railroad. Sizes may often be found that can be used to advantage to replace gasoline or fuel-oil engines which have reached the stage where repair parts, even if available, are not justified economically. With electric power, it may also be possible to arrange for automatic operation and thus make a saving in labor.

It is now of greater importance than ever to make certain that there shall be no delay to traffic in any way chargeable to failure of water-service equipment, and supervisory officers, although already making every effort to avoid waste or unnecessary use of critical material, have a greater responsibility than ever before to make certain that all water service equipment is being scrutinized carefully to anticipate failure of essential parts and to have repairs arranged for well in advance, so that there will be no stoppage of water production. Even the conservation of critical material is secondary to keeping each piece of vital equipment operating at its highest efficiency, and of constant inspection and maintenance so that it will continue to so operate.

. . . For the general discussion which took place on the material situation, see page 91.

Materials—Suggestions From W.P.B.

By O. F. Dalstrom

Assistant Chief, Way and Structures Section, Transport Equipment Division, W.P.B., Washington, D. C.

O. F. Dalstrom

Railway engineers are faced with restrictions in those two materials on which they depend most — structural steel and timber. A third material, cement, is unrestricted and can be had in quantity. Fortunately, reinforcing bars are also obtainable with little difficulty, permitting the substitution of reinforced concrete, where practicable, in projects where steel or timber would ordinarily be used. The restrictions on timber do not apply to piles, so engineers are free to design and build foundations almost to their liking, if they can do so without steel piles.

Lumber is scarce because of increased demand, shortages of manpower and equipment, and other factors. Timber must be used for many projects where speed in construction is a military necessity, such as munition plants, hangars, military railways, storage buildings, docks, and embarkation and loading piers. On the home front, it is needed for the repair or rebuilding of those timber railway bridges that were carried through the lean years of the Thirties beyond their normal service life, and must now be rebuilt to carry the enormous war traffic. Requirements for boxing and crating for the packaging of equipment and materials for shipment overseas are very large and are increasing, and are one of the chief reasons for the scarcity of lumber. Aircraft and other military items also make heavy demands upon the lumber supply, and housing and farm buildings take considerable quantities of lumber.

Thin Lumber and Steel Critical

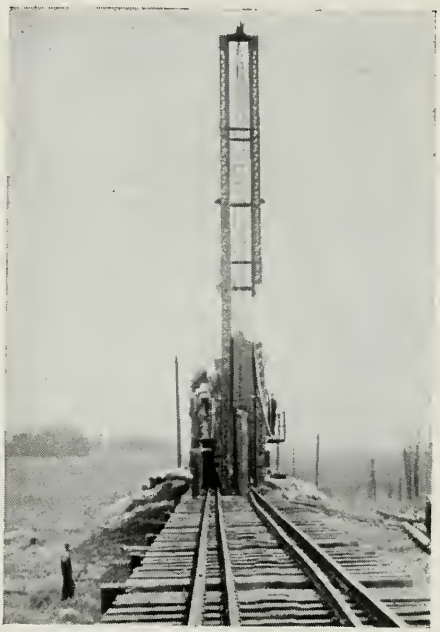
The scarcity of thin lumber is acute. The producer saws the log in the way that yields the greatest amount of structural timber, cutting up the remainder of the log into smaller sizes. This practice will continue so long as there is a shortage of all sizes. It is profitable for the producer. If the time should come when the supply of structural timber equals the demand, while there is still a shortage of thin lumber, then a greater proportion of the log will be sawed into thin lumber. For the maintenance engineer it is fortunate that the shortage of structural timber is less acute than that of thin lumber. The

safety of bridges depends on heavy timbers. Thin lumber is needed to repair or to restore buildings, but trains are not endangered if such work has to be deferred. The bridge engineer is hampered by lack of new form lumber, but it is nearly always possible to find substitutes. Used lumber will serve if he can find it, or can make it by sawing old bridge timbers into boards. There are firms doing a large business renting wood and thin-metal forms.

The shortage of carbon steel is also acute. Steel is being used in ever-increasing quantities as production is being stepped up in planes, ships, etc. Steel in some form goes into almost every type of equipment used at the fighting front. On the home front it is recognized that the railroads are a highly essential part of the war machine, and enormous tonnages of steel are going into rails, rolling stock, bridges, docks, car dumpers and engine terminals, to mention only a few of their materials and facilities. Here again the shortage is most acute in one class of product—flat rolled steel. This includes plates and sheets. The plate mills are working to capacity. There are ample facilities for rolling shapes, but there is not enough demand to keep the shape mills running to capacity. There is a good supply of reinforcing bars from re-rolled steel, and there is a disposition to allot all billet steel necessary for tension bars, thereby permitting the construction of concrete slabs for bridges where steel spans would ordinarily be provided. There is not enough carbon steel to go around, so we must contrive to get along with less than we want.

Confronted with these conditions, railroad engineers, supervisors and builders have a wide field for the exercise of originality and ingenuity. Old standards and old ways of doing work need to be re-examined. Tradition goes into the discard. The aim must be to save critical material while keeping structures safe. Cost is a secondary consideration. Build for the immediate future only, if that will conserve critical materials. The distant future will take care of itself.

First of all, every bridge must be made to last as long as it can be made to function safely by making repairs, replacing defective parts and reinforcing weak members. By replacing weak parts, a timber bridge can usually be kept in ser-



"Build for the Immediate Future Only, If That Will Conserve Critical Materials."

vice a year or two beyond the normal service life as determined by criteria in common use. Steel has the merit of being "good to the last drop." Old steel girders may be weak from wear and corrosion, that is, from reduction of section, but the steel that remains is the same quality as when it was built into the structure. If it had a yield point of 30,000 lb., what is left has the same strength after 40 or 50 years service. We are not here considering fatigue of metal, which affects only details stressed locally beyond the elastic limit.

Old steel spans that were headed for the scrap pile are being repaired, rejuvenated and put back into service, either on light-traffic lines under small locomotives, or cut down in length and reinforced in details for heavy service. With the highly developed art of arc-welding and the use of the cutting torch, all but the most dilapidated steel spans can be put back into service somewhere, and when that is no longer possible, they can be cut up for material to be used on other spans.

Old steel spans in service can be given the same treatment, and this is common practice. Steel spans designed for E-40 loading have been repaired, and weak parts strengthened, so that they are carrying safely locomotives with axle loads of 72,000 lbs. under unrestricted speeds. But it is proper to sound a note of warning at this point. Old spans cannot safely be loaded so far beyond their design capacity until every precaution has been taken to search out and strengthen or replace weak details and to repair defective parts. After this has been done, keep them under continual observation for signs of weakness, and be prepared to follow up with prompt action.

Use Non-Critical Materials

But bridges were not built to last indefinitely, even with the most thorough maintenance. Some bridges must be rebuilt, even in war time. But before deciding on the type for the new bridge, examine the conditions that determined the type of the bridge that is to come out. Conditions may have changed since that bridge was built. A concrete pipe or a short span, for example, may replace a timber trestle or a long span. A short realinement of track may reduce or eliminate bridges that were necessary on the original alinement, which may have been selected to avoid heavy earthwork. Where a structure of concrete, plain or reinforced, will serve the purpose that is the type to build now. A concrete arch may be substituted for a timber trestle. Reinforced concrete slabs on plain concrete piers, or on reinforced concrete pile piers, may be substituted for steel spans. Concrete pipe has long been in good standing among railroad men. Producers of concrete pipe are now offering the railroads a wide range of choice in sizes and designs of such pipes for drainage, cattle passes and small subways. Reinforced concrete piles are ideal for the construction of concrete trestles, and they can be driven in places where wood piles cannot be driven or cannot attain sufficient penetration.

This discussion does not purport to present anything new in construction. Rather, it is intended to emphasize the necessity at the present time of employing every resource that you developed and every device that you contrived

during the lean Thirties to conserve materials, improving on them where possible.

In submitting applications on Form WPB-617, keep in mind that the analyst of the War Production Board must know (1) exactly what is wanted, set out in enough detail so that he can determine how you arrived at your total quantities; and (2) why the improvement is needed now. This latter information is to be given in the answers to the questionnaire. Add extra sheets where there is not sufficient room on the form. Send prints of general plans, but only one print of each. The plans help the analyst to visualize the project and answer many questions that are not foreseen in making up the application or that cannot be covered adequately in a description. Put yourself in the position of the analyst whose recommendations must be fully justified by the evidence accompanying the project when he passes it on for approval and issuance of the final order.

In closing, it is fitting to pay tribute to the engineers in the bridge construction and maintenance departments of the railroads, their supervisors, foremen and the men in their crews throughout our country, who, while struggling with shortages of materials, and a scarcity of help, are working with determination, devotion and loyalty to keep the bridges of the railroads safe for the continually increasing burden imposed by the war.

GENERAL DISCUSSION ON MATERIALS

President Crites: We will have a round-table discussion of other expedients that have been employed to meet the shortages in critical materials, thus summarizing the papers that have been presented on this subject. In other words, we will treat materials as we treated labor yesterday. I would like to hear some discussion from the floor.

W. A. Huckstep (M.P.): This morning we discussed gutters and downspouts. Recently, on some car rebuilding sheds we had to provide downspouts to take care of the roof drainage, which was necessary because of so much electrical equipment and tools being used in these sheds, we resorted to the use of vitrified clay tile, protecting the lower portions by wood boxing. Subsequently, we made use of asbestos vent pipe, which can be painted readily and can be utilized in all classes of building construction as a substitute for cast iron pipe.

L. C. Winkelhaus (C.&N.W.): I would like to stress the necessity of using as much usable material as possible from buildings or partitions that are torn down, even though it costs more to recondition the material than to buy new material. I believe that under present conditions it is worth the extra cost involved to recondition any usable material, since it obviates the necessity of securing new material.

S. T. Corey (C.R.I.&P.): I would like to ask Mr. Bechtelheimer a hypothetical question. Suppose you had a bridge 51 years old, in which there were five 200-ft. spans, and that in this bridge, which was over a very important stream, you had experienced several failures under the operation of heavy power. Under present restrictions, I presume

it would be necessary to offer a very extensive argument for new steel. What would be the chances that a priority for new spans would be issued?

Mr. Bechtelheimer: It would be necessary to present a very strong case.

Mr. Corey: Do you think the chances of securing the needed material would be good?

Mr. Bechtelheimer: If you can show that the bridge should have been changed out 10 or 15 years ago, you might stand a chance. I say that because that was the decision given to me a short while ago. I had heard steel was being released. Later I had the opportunity of making direct inquiry on this matter and received this answer, "Yes, we are releasing a large tonnage of bridge steel, but most of it is for replacing spans that should have been replaced 10 years ago, and must be replaced now. It seems to me that if you can show that you should have replaced the spans 10 years ago, and you cannot operate the railroad without the steel, your chances may be good.

Mr. Corey: Under the circumstances, would we have to give them an analysis of the present steel in the bridge?

Mr. Bechtelheimer: I think it would be necessary to prove that your span is E-30 or E-35, for instance, and you want to operate E-60 or E-72 power over it. You must give information so they can determine that your analysis is correct.

Mr. Corey: What led me to ask that question was the instance cited, wherein truss spans were strengthened by building new piers at the centers of the spans. In the bridge I have in mind, the substructure is really not very good.

Mr. Bechtelheimer: Our substructure was not very good, either. If we had maintained the original length of span, it would have been necessary to rebuild or reinforce our sub-structure. We had five 135-ft. spans. We wanted to run heavier power over the bridge, so we put a new pier at the center of each span; also new end posts and portable bracing. The center section of each top chord was removed and floor-beams and stringers were reinforced.

President Crites: Are there other questions on this subject? If not, we will proceed with our program

The Car Supply—As Affected By Maintenance of Way Operations

By Warren C. Kendall

Chairman, Car Service Division, A.A.R., Washington, D. C.

(Introduced by President G. S. Crites)

W. C. Kendall

President Crites: The business of railroads is the transportation of people and freight. Seven - eighths of our income is derived from freight. In the transportation of this freight, cars are required. At the present time the railroads are handling a traffic that exceeds greatly that ever handled before, and they are handling it with 500,000 less cars than they had in 1929, the previous period of peak traffic. In spite of this great decrease in car supply, they have handled this traffic to date with an almost complete absence of car shortage. There is no longer any margin of safety however, and those familiar with the situation are quite apprehensive about the ability of railroads to provide enough cars to handle the traffic that the nation's activities will demand during the next few months. The railroads are checking the supply of cars accurately to utilize every available car to the maximum. Railroad officers themselves can do no less. They must reduce their demands for cars to an absolute minimum in order that the cars which they release can be made available for shippers. Primarily, this is for the transportation of munitions and other government supplies.

The distribution of these cars throughout the country is directed by the Car Service Division of the Association of American Railroads. This division has done an outstanding job in making the available car supply meet the record demands of these days. The Car Service Division is directed by Warren C. Kendall. He will bring to us a statement of our responsibility as railroad officers in meeting the nation's demands. Mr. Kendall, chairman of the Car Service Division of the Association of American Railroads. Mr. Kendall.

There is an interdependence of responsibility among all of us on the railroads to see that our job is so well done that it will contribute to the success of the railroad program in its entirety. We must not permit anything in any way to slow up or to affect adversely the processes which, day by day, are proving that ours is the industry which is admittedly outstanding in its effectiveness in aiding the prosecution of the war.

Without transportation, there could be no assembling of the personnel or the materials necessary to any war program.

Despite that fact that Germany got the jump on the rest of the world and, during a seven-year period, proceeded unchallenged by any nation to build the greatest war machine the world has ever known, our country, in less than two years, has carried through a program which in every way surpasses in its potential might that of anything previously conceived. And further, despite the many handicaps under which they have worked, the railroads are the one industry which has continued to produce, gaining in efficiency and volume, month after month, and has come through without criticism, delivering the products for war—the raw materials, weapons, ammunition, subsistence—in a manner which has brought forth the highest praise from those who sit in high places, and from all those agencies most directly concerned with obtaining the necessities for the war program.

The accomplishment has been so widely publicized in recent months that it is unnecessary to take your time to reiterate the record in any detail, but a few of the high spots are worthy of reference as a background to the discussion which will follow.

To measure railroad performance under present-day restrictions and handicaps, we naturally turn to the past to review what we did and how we did it. Many of us are familiar with railroad operations during the first World War. We also recall the lush period of the late twenties when traffic reached a volume not previously dreamed of. We remember the load the rails were carrying in 1916 and 1917. We recall the congestion of 1918, when demands for war purposes reached their peak. We recall the period from 1926 to 1929, when there were sustained loading periods of million car-weeks, that is, when week after week there were in excess of a million cars of revenue freight loaded, and peak weeks of one million two hundred thousand cars were recorded. Then followed the depression, when it was thought that nothing like those high traffic loads would ever again be offered to the railroads.

Things began to happen soon after Germany entered Poland, and they have been happening at an increasing tempo ever since. The peak of our difficulties as a transportation machine, however, still lies ahead of us. We must rise to our responsibilities. There is no other way. The job must be done.

We could not, or at least we did not, foresee the loss of our normal supply of rubber; of the control of the supply of petroleum and its products; of shipping, coastwise and intercoastal; and of many of those adjuncts to rail transportation we had come to take for granted. Nothing of this sort could happen. But it did, and the railroads were called upon to take up the slack.

With the continuing loss of traffic volume, both freight and passenger, beginning in 1930, the railroads, of necessity, reduced their ownership of freight and passenger cars and of locomotives. Railroad earnings were at such a low state that there was no money for purchasing equipment. Besides, there seemed no need to maintain the previous level of ownership. As a

result, there was a reduction of not less than 500,000 freight cars, 16,000 passenger cars and about 20,000 locomotives. It is important that we bear in mind that this reduced level of ownership has never been made up; nor does it now appear that it can be. Circumstances are proving that perhaps it need not be, except, perhaps, in part. There has been a gain in the capacity of newly acquired freight car units; also in the tractive power of those locomotives built. But the aggregate freight car capacity and locomotive power are still far below that of the equipment in service in 1929.

Bridge and Building Forces Must Do Their Part by Unloading Material Promptly

Organization—Important Factor

There has been one compensating factor resulting from all these experiences. Except for this, the story of railroad accomplishment could not be told. That factor is expressed in one word—organization. The railroads are now organized into a more closely knit group than ever before. And what is perhaps of greater importance, the railroads' customers, the shippers and receivers, have organized on a countrywide basis to demonstrate by their co-operation, one with another and with the railroads, what can be accomplished by concerted will to obtain the best possible use of freight cars.

Organization includes also those agencies of government which are so instrumental in giving direction to things which the railroads themselves could not do. The Office of Defense Transportation and the Interstate Commerce Commission, with its Bureau of Service, are indispensable to the effort which the railroads are now making to meet the demands which are forced upon them. And last, but by no means least, the biggest single customers of the railroads, the Army and Navy, have organized their transportation requirements in such a manner as to meet most effectively the operating practices of the railroads, and at the same time serve themselves to the best advantage.

Remarkable Achievement

As the war in Europe developed and our own war clouds began to gather, the disciples of disaster, of whom there are always too many, began to cast before the public forebodings as to the inevitable inadequacy of rail transportation. In the fall of 1941, and prior to Pearl Harbor, there came from several sources, and from those

high in authority, advices that a breakdown in transportation lay just ahead. It is significant that this gloom did not originate with railroad men, for they never lost confidence in themselves.

I quote from publications and from the public press of that time: "This country is now teetering on the edge of a transportation shortage. We face this fall and in the coming year a critical situation in all modes of transport. If industrial production fails to increase during the fall months because of shortage of raw materials, it may be that the railroads will squeeze through this year . . . . Should defense production move forward rapidly in the early autumn, a railroad shortage as high as 40,000 cars a week may develop in October." There was no evidence of shortage of raw materials, and there was an increase in production, yet the railroads took everything in stride, and instead of the car shortage which was forecast, there was a comfortable margin of supply.

From another source: ". . . . a new report estimates that the carriers will be short 80,000 cars at the peak of traffic this fall, and we need 370,000 new cars by the fall of 1942. These figures are based on very efficient operation of cars." You will note that this expert doubled the count of the anticipated shortage, and told how future shortages were to be overcome. He could not then reckon with the restrictions placed around the distribution of steel by W.P.B.

In another instance we were told the following: quoting from a press report of a release by a recognized agency: ". . . our economists watching production figures and car loading reports of the Association of American Railroads realize that increased demands upon the carriers, currently more than 15 percent above normal, forecast a shortage of car loading facilities in the week ending October 13. That shortage, because of heavy defense demands and seasonable causes, tends to increase through the fall, probably reaching a peak through the week ending October 25, when the shortage will reach 49,978 car loads." One wonders why they did not locate a potential shortage of 22 cars more from some stricken industry to round out an even 50,000 cars.

It was in the air at the time, and perhaps one should not be surprised that with the rapid increase in industrial activity as the country was beginning to assume its place in the world as the Arsenal of Democracy, those who were looking on from the outside should look upon the transportation situation with some anxiety. Perhaps we all did, but if so it was electric in effect, for it prodded us to action to prove our critics were false prophets.

We may now take some measure of the error of these prophets of doom. The total net ton miles for the war year of 1918 was 405 billion, and for that banner year of heavy traffic volume—1929—ton miles totalled 447 billion. In 1941, the year when a serious car shortage was forecast, net ton miles totalled 475 billion, or 70 billion above that of 1918. It is now estimated that the net ton miles in 1943 will reach the astounding total of 730 billion, which is nearly equal to the combined total of the World War year 1918, and 1939, the year just prior to the outbreak of the present war. It is of particular

importance to bear in mind that this is being accomplished despite that reduction in equipment ownership mentioned previously—500,000 less cars and 20,000 fewer locomotives.

The railroads have been making new records month by month in car handling, which are indicative of their present-day efficiency.

Miles per car per day are now averaging 47.7—a new high. When the railroads announced their program of rehabilitation in 1923, a goal was set of 30 miles per car per day, which at that time seemed difficult of attainment. In only one month of 1923—October—was this goal reached. For that month the average miles per car per day was 30.7. It is significant that in 1924, in only one month—again October—did the miles per car per day reach 30. In 1925 there were three months in which the miles per car per day was in excess of 30—September, October and November.

Average tons per car of carload freight for the first quarter of 1943 amounted to 40.61. This figure compares with 37.56 for the year 1942 and 34.5 for 1923. If the same tonnage handled in 1942 had been loaded to the average of 40.61 tons per car, attained in the first quarter of 1943, there would have been an equivalent of 114,632 cars saved.

The average turn-around time of serviceable cars for a recent month was 13.3 days. This is not the lowest turning time of record. It is generally figured that with the present level of loading, one day quicker turn-around time is equivalent to the saving of approximately 100,000 cars. In this connection, it should be stated that the present turn-around time is affected by the longer distances that loaded cars are handled. The average haul per ton of freight for the first quarter of 1943 was 515 miles. This compares with 454 miles for 1942 and 351 miles in 1940.

Other new records are being made, such as net tons per train, freight cars per train, locomotive mileage, both freight and passenger, etc, all of which are most important factors in the service which the railroads are now rendering the public, and referred to frequently as nothing short of miraculous.

Reference should be made also in passing to the great increase in passenger transportation, for that also absorbs locomotives and manpower. A high point in the number of passengers transported one mile occurred in 1920. The passenger miles for that year totalled 46 billion. An interim low was reached in 1939, when the total was 22,600,000,000, or less than half that of 1920. In 1943, it is now anticipated that passenger miles will total not less than 80 billion, or approaching four times the volume of four years ago.

Nothing short of the utmost in teamwork on the part of everyone has been instrumental in producing these results. Every department of the railroad has worked with every other department, supplementing each other's efforts toward a common purpose. It has been a remarkable demonstration of what can be done when the pressure comes.

Records of Car Delays

At this point let us see how we have performed in the matter of car handling. We have been both good and bad, in spots. The Car Service Division obtains twice each month, and from each railroad, a statement of revenue cars under

load with company material, divided between company coal and coke, and "all other." These statements show the number of cars held under load and the average days detained.

The statement for September 15 shows, other than coal and coke, that 10,500 cars were being held under load for an average of 3.9 days. When those in your department consider that these data include cars under load with ties, rail, fastenings, and the like, it probably seems to you not so bad. But remember, this is an average figure of detention, including the 20-day car and the 1-day car. If a shipper or consignee holds a car 2 days beyond free time, he is assessed $2.20 per day for each car so held, and after two days at this rate, he is assessed $5.50 a day for each day the car is detained after that period. Compared with records of a few years ago, this average of 3.9 represents a substantial improvement. But it is not as low as it should be, or as low as it can be.

This same report of September 15 shows one large road holding hundreds of cars under load with company material an average of 11.6 days. Another one 4.0 days. Comparably sized or even larger roads show records of 2.6, 2.1 and 1.2 days, respectively. Of the smaller roads, one shows 49 cars an average of 8.0 days. Another 54 cars 4.3 days. Other medium-sized roads show 24, 5, 4, 3 and 2 cars detained 1.3, 1.0, 2.0, 2.0 and 1.0 days, respectively. It can be done.

The Car Service division also has a corps of service agents scattered among the railroads of the country, who make daily reports of various car service items which fall within their observation. Let us look at some of these items.

Points in the West:

(1) 9 cars of rails and fastenings held an average of 22 days, and 1 car accumulating scrap held 106 days.

(2) 13 cars lumber, brick and wheels held 8 to 21 days.

(3) 3 cars of lumber held 8 to 19 days.

(4) 15 cars of various materials held for the engineering department 6 to 71 days, for an average of 43½ days. Many of these were cars of foreign ownership badly needed in home territory.

(5) 52 cars held up to 40 days, with an average of 20 days per car, awaiting orders from the roadmaster.

Points in the East:

(1) 5 cars of roadway material held 11 to 52 days.

(2) 26 cars of rail held an average of 10.5 days per car, and 9 cars of ties held an average of 5.4 days per car.

(3) 15 cars of bridge and building department material held 92 days, or an average of 6 days.

(4) 6 cars of bridge and building department material held an average of 10 days.

(5) 25 cars of lumber held 2 to 12 days for an average of 5 days.

(6) 57 cars of material for supervisor, roadmaster and engineering department held an average of 8 days.

Coal hopper cars are greatly in demand at the present time, and yet on two roads where there is a current shortage of hopper cars for coal loading, 26 and 14 hopper cars were noted under load with material which had been held, at the time reported, for an average of 6 and 13½ days respectively.

Cars are worth, for revenue purposes, an average of $10 per day. The total cars reported under load with company material, other than coal and coke, as of September 15, totalled 10,500. This, at an average of 3.9 days per car, totalled 40,950 days. The potential earning capacity of this equipment to its owners was $409,500 for the period held. We should ask ourselves the question—how much can I, as an individual, contribute in time of need to my railroad and to the public it serves, by closer supervision?

What Lies Ahead?

Those who are best informed on what lies ahead forecast that demands for freight transportation in 1944 will require that railroads deliver about six per cent more ton miles than in 1943. This may need revision upward, depending upon the supplies of rubber and gasoline and the progress of the war. It seems unlikely that it will be revised downward.

No great amount of new equipment can be expected within the next 12 months—perhaps 40,000 cars. Possibly 1,000 new locomotives may be made available. With the prospects of increased demands for rail transportation, and no material increase in the availability of freight car equipment, it becomes evident immediately that the railroads must do even more with what they have than has been done in the past.

Director Eastman of ODT is calling for a 10 per cent increase in efficiency in the handling of cars. He is organizing committees to that end. Judging from past performances and from the known slack which still exists, the 10 per cent may not seem too high a mark at which to shoot. Personally, I have some doubt as to our ability to reach this rather extravagant objective. We should, however, try and do nothing less than our best. If we reach five per cent, or even three per cent, we shall indeed record a performance that will go down in history as remarkable. It is quite unnecessary for me to add that each one of us recognizes that a job has been laid out for us to do.

Maintenance Men Can Help

What can the maintenance of way and structures forces contribute?

So far I have referred specifically only to the more prompt release of cars under load with company material as a contribution which those in your departments can make toward increased car efficiency. There are others.

Despite the shortage in manpower, it will doubtless be found possible to transfer company material, which must be kept on cars for temporary periods, from revenue to non-revenue equipment.

When loading material which is for local distribution, use maintenance of way or non-revenue cars for such loading.

When using revenue cars for company material, see that they are loaded to capacity—cubical or weight. For example, a gondola

car will carry three or more times as many ties loaded on end as when loaded horizontally with the top of the sides of the car.

Don't load cars in advance of actual requirements for use or distribution. The cleaning of cars is usually under the supervision of the maintenance department. See that cars on the cleaning tracks are conditioned with the least possible delay.

It is assumed that possibilities of improvement in methods and material entering into construction and maintenance have by no means been exhausted. Yard layouts, locomotive terminals, reduction of curves and grades, improved signaling, and facilities identified with train operation generally, are all doubtless susceptible of improvement if we but search for the various answers. Research also applies to car handling.

There is a part for each to play in developing his opportunities, and the obligation rests upon all of us to help maintain our railroads in the high place thay now occupy among industries serving the nation in its war program. Let research, more research, and still more research, be our watchword: With this constantly in mind, we shall not miss the goal.

DISCUSSION

President Crites: Mr. Kendall, on behalf of the American Railway Bridge and Building Association, I want to thank you for this informative message that you have brought to us. When you started out by speaking so encouragingly on the things we have done, I was a little fearful that some of our members might go home and think that all possible had been done with respect to releasing cars. Later facts presented show that is decidedly not the case, and it is that part of your report we should take home and ponder.

We heard yesterday that in some places women have been used for unloading material on the line, and that especially in the West, where labor conditions are extremely acute, women have been employed to unload cars at storehouses and thereby release cars that are badly needed for the transportation of munitions and government materials.

R. E. Dove (C. M. St. P. & P.): Mr. President, I just want to mention that I have a contractor friend who has been doing some government work, and, to show the importance which the government attaches to the release of cars, he has not been permitted to have a car on the property more that 24 hours. He said this ruling meant that he had to unload his material on the ground many times when it was not needed and where it was not wanted, but it was mandatory to release the cars as the government would not countenance any report of a delayed car in that area.

President Crites: If the government authorities can put out orders of that kind, it seems that we, as railway bridge and building men, should take this situation to heart and see what we can do along the same line.

Elmer T. Howson (Ry. Engr. & Mtce.): I want to make one comment, Mr. President, in line with what Mr. Kendall has said, that I think might help drive home to us

the seriousness of this situation. I attended an emergency meeting of the Northwest Regional Advisory board at St. Paul two weeks ago, which had been called to consider the necessity of getting cars into the Northwest because more than 1,000 elevators in that region were closed, and the grain was being piled on the ground at a time when there is a tremendous demand for it, both here and abroad. Last week I was in St. Louis—Mr. Kendall was there—where the National Association of Shippers' Advisory Boards was holding a meeting, and making reports of the steps which shippers are taking to release cars.

The measures being taken by numerous shippers put many railway men to shame. Railway men are delaying cars at a time when shippers are working overtime, are maintaining forces Saturday afternoons or all day Saturday, and are retaining them on Sundays and at night to release cars. I think Mr. Kendall will be the first to say the shippers have done a magnificent job in meeting this car situation, and wherever there is an individual railroad man who is not stepping into this situation in that same way, he is letting down the industry of which he is a part.

Mr. Kendall: Mr. President, I could stand here for an hour and tell you of instances which are comparable to those just mentioned. There are many instances where the government is directing the prompt release of equipment, and holding contractors and its own personnel to just such efficiency.

On the other hand, the army is a pretty large organization. You know how widely its forces are spread out over this great country of ours—and they have not reached all the corners yet. They have some bad spots in releasing cars, just as you men have some, but they are all working to ferret out these spots, and to apply the necessary remedy.

Mr. Howson referred to the situation in the Northwest, which I think calls for just a word of additional comment, for I would not like word to get out to the public—certainly not among our railroad friends—that there is any serious car shortage. In one sense there is no car shortage in the Northwest. It is true that there were at one time about 1200 elevators closed for want of cars; the latest figure that I have is about 700. That reduction has been effected in about a two weeks' period by the forwarding of empty box cars from the South and the East into the Northwest. But the average loading of grain and grain products in the Northwest is higher than ever before, and the reason for the closed elevators is that the farmer is getting such good money for his grain that he wants to ship it now.

The government has plenty of bins, steel and wood, scattered around that area, but the farmer is not interested in storing his grain there. Last year he was holding it back. Today, he is pushing it out. In view of this situation and the enormous movement which is now being made, we cannot admit that the farmer is suffering for want of cars in that area; certainly not as he was in 1922, which was something of a nightmare to all of us.

President Crites: Mr. Kendall, I thank you again.

Railway Men At War

By Lt. Col. Robert A. Radford

Chief, Engineering Branch, Railway Division
Office of Chief of Transportation, U. S. Army, Washington, D. C.

Put a railroad man in uniform and he will look like a soldier after the rough edges are buffed by basic training. It is a matter of experience that a railway battalion must be as well trained and disciplined as any other military outfit. This is because they are more widely scattered and on their own in small units so much of the time. A railroad man in a railway battalion, however, always remains a "railroader," from his G. I. shoes to the tanned visage under his G. I. cap. Make him a captain and he will still be a railroad man. Make him a general and he will continue to think in terms of rights of way, rolling stock and roundhouse engine pits.

The Military Railway Service is an integral part of the Transportation Corps of the army. Its units are organized and activated from the various railroads of the country and receive their technical training under the leadership of Maj. Gen. Charles P. Gross, chief of transportation. Such matters are handled through the Rail division under the direction of Col. John A. Appleton, general manager, New York zone of the Pennsylvania.

The units, set up on military lines, are constituted to function as a practical railway operating organization. The senior officer in a theater, usually a brigadier general, is general manager of the Military Railway Service and, with his headquarters, commands all rail operations. Directly under the general manager are a number of railway grand divisions, each commanded by a colonel, who functions as a general superintendent. In a typical railway grand division, there are three or four railway operating battalions, each commanded by a division superintendent; one railway shop battalion, commanded by a general shop superintendent; one railway base depot company, commanded by a storekeeper; and a railway workshop (mobile), commanded by a master mechanic.

The railway operating battalion is made up of four companies: Headquarters and Service Company, in charge of supplies, dispatching and signal maintenance; A Company, charged with maintenance of way, track and bridges and buildings; B Company, charged with maintenance of equipment, car repairs, and roundhouse activities; and C Company, with 50 train crews, in command of a trainmaster.

Railway units, once trained and shipped over seas, are under the commanding general of the theater Such units have now gone forth to many parts of the world.

A military railway operating bat-

talion has taken over the operation and maintenance of the White Pass & Yukon between the port of Skagway and Whitehorse, near the headwaters of the Yukon river. Last fall, Whitehorse suddenly became a focal point of strategic interest. The great Alcan highway was being constructed from near Edmonton, Alta., to Fairbanks, Alaska. Personnel, materials and supplies for the construction of this road could be moved both north and suth from Whitehorse. The town was also to be the western terminus of a 450-mile pipeline under construction from the oil wells of Norman, up near the arctic circle on the banks of the Mackenzie river.

The White Pass & Yukon, constructed in 1901 to serve those who sought their fortune in the Klondike gold rush, has been operated continuously by a London Syndicate. On October 1, 1942, the line was taken over by the War Department, under a continuing lease executed by the owners. By the terms of this lease the Transportation Corps of the army will operate the line for the "duration of the war and one year thereafter."

Never equipped to operate as a heavy freight line, and always harassed by severe winter operating conditions, it was physically impossible for the company to handle the suddenly imposed war load. With the execution of the lease, a military railway operating battalion, now commanded by Lt. Col. Herman C. Boughn (A. T. & S. F.), was given the task of rehabilitating the facilities and providing an adequate operating personnel. The battalion has moved over this famous route, with surprising regularity, the largest tonnage in the history of the road.

I went over this road with some others just before it was taken over. We had flown to Alaska and the pilot and co-pilot, who had flown us to Alaska, made the trip with us. On the way back they wanted to ride the locomotive. After a few miles and after passing over some of the bridges, where they could look right down into space from the engine, they gave it up and announced that hereafter they would stick to flying.

Needed Help

Many years ago, military experts proclaimed the control of Alaska as imperative to the control of the Pacific. Dutch Harbor, Anchorage and, later, Fairbanks, became sites for army installations. In 1914, Congress authorized the President to construct and operate certain railroads in the territory of Alaska, and in 1923 the Secretary of Interior was authorized and directed to take over and operate the line between Seward and Fairbanks.

Confronted by heavy war traffic and an increasingly critical manpower shortage, the management of the Alaska Railroad submitted a request to the War Department for prompt and material assistance. A railway battalion, under Lt. Col. Herbert S. Huron (C. St. P. M. & O.), was moved in to supplement the civilian personnel in the maintenance, rehabilitation and operation of the line. A recent report from the Interior department's general manager of the Alaska Railroad brings news that this battalion is functioning with all the efficiency of an American railway organization. Because of much de-

ferred maintenance, it has been necessary to establish maintenance-of-way camps throughout the length of the line. Fifty-three such camps, with 53 separate messes, are now being operated, and a post-exchange car operates regularly up and down the line. Just how long it will be possible to retain these battalions on these Alaska railroads will depend upon strategic requirements placed upon the Military Railway Service as the war develops.

Moving nearly a third the distance around the world and below the equator, in the Southwest Pacific, we find a tiny railroad on the French island of New Caledonia. This island, it will be remembered, was to have been the southwestern point of the Japanese great strategic crescent. Unfortunately for Tojo's plans, however, the Americans arrived there first. A railway operating company is now operating this 22-mile narrow gage railroad from the capital city, Noumea, to the dumps, warehouses and camps behind the port.

Also in Iran

From the two principal ports on the Persian gulf, Banda Shahpur and Khorranshahr, standard-gage rail lines run northward to join at Ahwaz and from there to the capital at Tehran, some 600 miles from the gulf. At Tehran one line of railroad extends in a northeasterly direction to the Caspian seaport of Bandar Shar. A second line has more recently been constructed to the northwest where it will eventually connect with the Russian railroad at Tabriz.

The Russian national railroads extending south through the Caucasus and Armenia, terminate at Tabriz. These are of 5-ft. gage. The unfinished gap between the Persian railroad and the Russian line is approximately 80 miles, over which all supplies are transported by truck train. At the close of 1942, arrangements were made whereby the operation of the lines between the Persian Gulf and the capital was turned over to the American Persian Gulf Command. By January, 1943, the operations of this railroad were in the hands of American military railway units, then commanded by Col. Arthur E. Stoddard and his Union Pacific grand division headquarters. With him were Lt. Col. George W. Welch (C. St. P. M. & O.). Lt. Col. John J. Clutz (Penna.) and Maj. F. E. Russel (S. P.) in command of battalions. Because there are heavy Diesel operations on these lines, the Diesel shop battalion, sponsored by the American Locomotive Company under command of Maj. W. C. Rogers, is also on duty in this area.

The Russian government's objective of munitions and supplies to be delivered by the Americans is being exceeded. This is in addition to the normal traffic of the country, plus our own and British requirements. The operation has gone far toward removing all evidence of friction among the allies on matters of supply to Russia. In truth, Tehran has become a meeting place of friends between American and Russian transportation men.

The operations at Iran will make an interesting chapter in the history of American railroading. Stories of mixed train crews, with absolutely no understanding of each other's language, have been told

frequently. If it were not for the fact that all railroad men understand each other's needs and signs, it would be difficult to understand how an American doughboy conductor could impart orders to a bearded Persian engineer. The Persian personnel are retained in addition to our own troops in charge.

This railroad itself was splendidly built, but the methods of communication were totally inadequate. These have been remedied by installations of our signal corps, and with the operation and maintenance by railway operating battalions.

Among the Pyramids

A thousand miles to the west of the Persian gulf is the great ditch through the desert, known as the Suez canal. English-built railroads parallel the canal and extend westward to Cairo, Alexandria, and into the western desert to within a short distance of Tobruch. Because of a lack of water and coal, the operations of these Egyptian lines are largely by Diesel power. Here we find an American railway shop battalion under command of Lt. Col. A. R. Walker (I. C.). It has been the duty of this battalion to unload, assemble, keep in repair and, in part, operate American Diesel locomotives. A large part of their work is performed by semi-mobile units placed at strategic points between Suez and El Alamein. Their work is of such importance that their retention in that theater has been specifically requested.

As Time's correspondent (June 14, 1943) commented so aptly: "It certainly was a hell of a way to run a railroad, with German tanks pumping shells at your locomotives from ranges as close as 150 yards and demolition charges double-crossing your bridges before you could come to them."

So far we have been going around the world in giant strides. Before we come to the last, the most active and most interesting theater, I want to go a little bit into "planning." Some features of this matter I feel are of particular interest to this organization.

Before going into a new theater, complete physical details of the railroad facilities must be known. It is necessary to know, if such information is obtainable, the grades, weight of rail, kind of turnouts number and kind of locomotives and cars and the number and sizes of bridges.

With this information available, the planner then figures out how much tonnage can be forwarded over a given line and the troop basis is dependent on this. The number and kind of military railway battalions must be planned and the kind and amount of material which must be available immediately. This, as you can understand readily from your own knowledge, runs into a multitude of items, all of which must be planned, stocked and available months in advance.

One of the most difficult items for which to plan is bridges. If the kinds of bridges and lengths of span are known, it is a big step forward. The next and most difficult step is to make some sort of intelligent estimate or guess as to just what percentage of such bridges will be destroyed by the enemy.

Even where bridges have been destroyed, much of the material may remain usable. One of the German practices is to carry along

I-beams or girders which can be welded in to replace broken chords. The American forces stock certain kinds of bridges for different lengths of spans. These include girder bridges, deck trestles and through trusses. The trusses and trestles are sectional and flexible as to lengths within certain limits. They are all bolted and so designed that additional sections may be added.

Necessarily, in the field, one resorts to every kind of makeshift. The accompanying illustrations which show damage to bridges and the methods of repair, will be of interest. In some cases, sectional spans have been used; in others, a span has been filled in with earth; and in still others, the bridge has been by-passed with a piece of track.

One of the complications connected with such repairs is that the locations may be mined. The wreckage makes a splendid place for booby traps. When you start to clear it away, you find an innocent looking piece of timber or steel hooked up to set off a mine.

Theoretically, the rehabilitation of the railroads is a function of the Corps of Engineers who turn over the repaired railroad to the Transportation Corps for operation. Actually to date, most of such repairs are done by the track and maintenance companies of the railway battalions.

Also in North Africa

The number one railroad man in North Africa is Brig. Gen. Carl R. Gray, in civilian life executive vice-president of the Omaha. Some of the higher ranking officers with him are Lt. Col. Fred W. Okie, division superintendent from the Southern; Lt. Col. J. J. Daugherty, master mechanic of the Southern Pacific; Lt. Col. Charles D. Notgrass of the Santa Fe; Lt. Col. R. J. Crane of the New York Central, handling bridges; and Lt. Col. B. H. Decker of the Denver Rio Grande & Western. So it goes through a long list of officers, well known in shops, offices and on the roads in this country.

Trains under military control in North Africa run from the Atlantic ocean across the continent to beaches at Tunis. They carry troops, Arab labor battalions and, separately, goods for civilian consumption. This tonnage rolls in a variety of equipment, ranging from the old World-War type of "40 hommes, 8 chevaux" box cars, to modern steel gondolas brought from the United States. The main line following the coast is standard gage. The branches that go off to the south are 1-meter and 1.05-meter gages. The locomotives range in type from electric and Diesel-electric to steam, and in vintage from 1899 to just before the war. American locomotives are brought in crates and assembled in the shops at the ports.

Railroading here is an international melange of United States, British, and French military personnel, French civilians and Arabs, with troops handling entirely movements near the front. Obviously, it is rich in anecdote. I am quoting from a report of one engineer's experience to give you some idea of the difficulties of train operation:

"I am taking this rattler along about 45 miles an hour when we start down a two per cent grade.

Further along we pick up ten miles an hour. I think that'll be enough, so I whistle once for brakes. Over here we have no air. We have Arab brakemen scattered along the train with hand brakes. One whistle means brakes—most of the time, not always. This time all the brakemen were asleep.

"By and by, this choo-choo is rolling along at 65 miles an hour. My fireman is sitting on the French engineer to keep him away from the throttle. He wants to reverse the thing. You can do that on a French engine, but on this Yankee engine, it would strip the valve gears.

"You're supposed to stop at every station to get clearance for the next—not my train, for we went through four stations, and the chefs de gare were all out waving at us and hollering like hell for us to stop. Back in the caboose, I learned later, the lieutenant had the French conductor down in a corner and was sitting on him to keep him from jumping. Finally, we hit an up-grade and slowed down. So we went back and slapped the Arabs awake and went on, away ahead of schedule."

Sleeping Arab brakemen are the least of the hazards of the road. Further forward along the fighting front, the operating forces are exposed to many dangers, including mined tracks, strafing and dive bombing from the air, and action by enemy patrols. Mined tracks were considered more of a nuisance than a hazard. After each new piece of roadway was taken from the enemy, a track-walker trained in mine detection traversed the line. Later, when the first train rolled, it pushed three empty flat cars ahead of it. If an undetected mine had remained, a car would have been damaged, but a precious locomotive would have been saved. A few locomotives have had to undergo repairs from damage caused by strafing in the earlier phases of the Tunisian campaign, but as enemy air-power diminished, trains ran unmolested to the front.

In this campaign Lt. Col. Okie was decorated, as were a number of others, for various exploits. His decoration reads in part:

"Lt. Col. Okie organized and led a detachment of his battalion beyond our own lines to the vicinity of Moulares, Tunisia, to attempt to bring out two trains of ammunition, which had been abandoned after a rapid enemy advance. When enemy forces closed in and made movement of the trains into our lines impossible, he supervised the destruction of the locomotives, assembled his detachment and a number of civilian refugees, and led them all to safety by a circuitous route through the desert to Tebessa."

Working to the last minute, the Colonel barely got out of one town as German tanks entered from the opposite side. Racing along in two trucks, loaded with his crew, he was fired on point blank by an anti-tank gun, but managed to get into mountainous country, where he drove up the bank of a dry river bed, escaped with his convoy and disappeared.

Lieutenant Colonel Okie's battalion was again cited by General Patton in Sicily. It landed an advance reconnaissance party at Licata, reconnoitered the rail yards, organized the civilian rail workers, located equipment, got up steam on a locomotive and made a pioneer run over part of the road, all within

four hours from the time they hit the beaches.

Twenty hours later, full trains laden with vital supplies were running into the Third division's forward positions, thereby releasing divisional truck transport for battle duties. The reconnaissance party was led by Maj. C. O. Butler (A. C. L.), and Capt. Marvin L. Horton (A. C. L.), both of whom received the soldier's medal.

Despite a nightmare of mines, strafing, sabotage and other retarding influences, the opening of the rail lines and reorganization of the Italian railroad personnel was made so rapidly that rail service was available into Palermo on July 28, when the port was opened.

We have as yet no detailed information on railway operations on the mainland. I did see a dispatch which said that the engineers, under Maj. Arthur G. Teets, were now operating out of Naples. Major Teets (N. Y. C.) is executive officer with a military railway battalion.

We have gone a long way around the world, but I think this gives, without too much detail, a fairly comprehensive picture of what your associates are doing.

Revising Working Practices to Eliminate Interference with Traffic

Report of Commttee

Committee—L. R. Lamport (*chairman*), Chicago; G. W. Benson (*vice-chairman*), supervisor bridges and buildings, C. of Ga., Macon, Ga.; R. W. Cassidy, assistant cost engineer, C. & O., Richmond Va.; A. B. Hillman, engineer maintenance of way, C. & W. I.-Belt, Chicago; Howard C. Madson, designer, C. & N. W., Chicago, assistant to chief engineer, C. & N. W.; C. A. J. Richards, master carpenter, Penna., Grand Rapids, Mich.; A. C. Jones, bridge and building supervisor, Sou., Parrish, Ala.; M. H. Dick, Eastern editor, Railway Engineering and Maintenance, New York; R. C. Baker, bridge and building supervisor, C. & E. I., Danville, Ill.; R. E. Caudle, assistant engineer of structures, M. P., Houston, Texas.

L. R. Lamport
Chairman

Since the first World War, there has been a general development of heavier locomotives capable of greater speed and with them improved rolling stock, roadbed and structures, all of which have resulted in a gradual shortening of schedules. These developments have been more pronounced following the depression years, in which period the railroads entered an era of speed in train operation—both passenger and freight.

Train Speeds Increased

In order to recover passenger business lost to other forms of transportation before and during the depression, train speeds were increased and the first streamlined train made its appearance in 1934. That train, with its maximum speed of more than 100 miles per hour, and other similar trains were accepted so readily by the public that this type of passenger service has now become commonplace. The shortening of schedules of trains with heavier-type equipment soon followed the advent of the lightweight train so that today there are few so-called slow passenger trains except on unimportant branch lines.

While perhaps not so spectacular as with passenger trains, the shortening of freight train schedules has been given similar attention in the interest of competition with other forms of transportation and recovery of business. As a result, maximum freight train speeds of 60 miles per hour are being maintained today on the more important lines throughout the United States and Canada, important regularly-scheduled trains making overnight runs between terminals 400 to 500 miles apart.

Previous reductions in train schedules have played no small part in the remarkable performance of the railroads since the attack on Pearl Harbor on December 7, 1941. With less equipment than was available during

World War No. I, the railroads are carrying a greater volume of traffic, both freight and passenger, through increased speeds made possible by improvements in equipment, roadbed and structures.

Effect of Slow Orders

All who have the responsibility of maintaining structures under present-day traffic conditions must bear in mind that an unscheduled reduction in speed may mean a delay in arrival at the terminal, with far reaching effect on connections. With our nation at war, it is more important than ever that troops and war materials arrive at their destination on schedule.

In 1936, your committee on Adapting Bridge Maintenance Methods to Today's Requirements for High Speed Train Service referred to tests made by the Pennsylvania to determine the value of unrestricted track in its high speed electrified service between New York and Washington, as follows: "In making these tests, a 30-mile restriction was placed on one half mile of track at various places to obtain different combinations of grade conditions. On level grade, if the reduction was from 75 miles an hour, it required 3.14 miles before full speed was again attained. From 90 miles an hour, this distance was increased to 6.14 miles. When the restriction was on an ascending grade of 0.4 per cent, these distances were 3.81 miles and 12.12 miles respectively. These data showed that if speed restrictions are to be placed from 5 to 12 miles apart, depending on grades which do not exceed 0.4 per cent, there will be no advantage in raising the maximum speed."

The data obtained from these tests, carried out under favorable grade conditions, make it readily evident that reductions to speeds of 10 or 15 miles an hour from high passenger or freight train speeds, particularly with unfavorable grades, mean losses in time which may not be recovered.

Traffic Must Be Considered

While it is recognized that bridge work cannot, in all instances, be carried out without interference with traffic, continued effort on the part of engineers and supervisors to revise working practices in the construction and maintenance of structures has done and will do much to shorten the period of time that slow orders are required, or eliminate them altogether. In order to accomplish the desired result, traffic conditions must, together with economy, be given first consideration by those in the field when making recommendations for improvements or repairs. Field surveys must be in sufficient detail to give the designer all the information necessary to enable him to develop plans for a new structure so that the construction work may be carried out with the least interference with traffic.

On the more important structures, after plans are completed, a definite schedule for carrying out the work should be made and studied in conference, preferably at the site, by the bridge engineer or his representative, the division engineer, and the supervisor, calling in a representative of the operating department for information on train movements and schedules. Such a conference may result in changes before the final plans are made, but it will reduce traffic delays to a minimum.

While the design of a structure exerts a very definite influence on the elimination of interference with traffic, close field supervision and contact with the work are of first importance. The supervisor must be in constant contact with his crews and train them

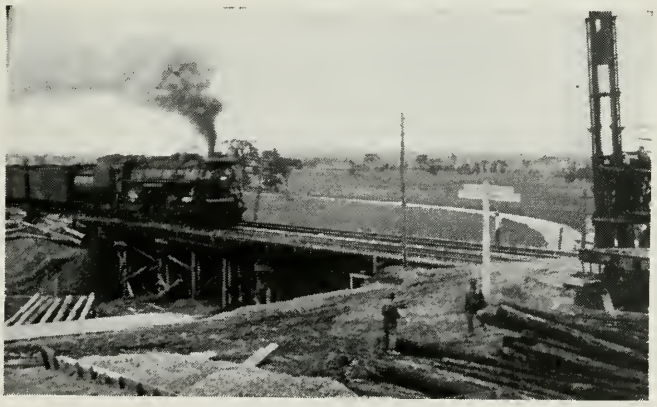
to meet the conditions that arise on their respective territories. He must have a thorough knowledge of train operation and be in constant touch with the dispatchers and other operating officers to insure that working schedules are made to fit traffic conditions.

On some railroads, high speed streamlined trains operate on other than daily schedules; and there are instances of important high speed freight trains which do not operate daily. With a thorough knowledge of such train schedules as these, and through taking advantage of them in programming the work, traffic interference may often be avoided entirely on projects which would otherwise require slow orders.

The furnishing of crews with improved power tools and newly-developed machines has contributed greatly toward the reduction in the time required to perform work, with the result that traffic interference on structures where this equipment is used is held to a minimum. Compressors of the type requiring long pipe lines are being replaced by more compact portable types mounted on rubber tires. Improved air tools including drills, impact wrenches, rivet busters, rivet hammers, etc., have been made available for steel bridge crews. Likewise, air saws, wood borers, and wrenches are being provided for crews performing work on timber bridges and timber decks on steel structures.

Many roads are equipping their crews with electric generator sets of various capacities. Some of these are of sufficient size to operate a wood borer, a circle saw, and also a large chain saw for cutting stringers and other large timbers and for making pile cut-offs. Gasoline-driven flexible-shaft power units equipped with wood borers, wrenches, and saws have now been in use a number of years and can be adapted readily to bridge work, particularly for deck renewals. The carrying by crews of cumbersome jacks, with the loss of time incurred by their use, is no longer necessary for developments in this tool have been such that a suitable number of jacks of an efficient type can be had by each crew without over-stocking the tool car.

Modern work equipment, including pile drivers, locomotive cranes, and gasoline driven cranes, has to a great extent replaced obsolete equipment, with the result that the time required for performing work is reduced to a minimum. The drop hammer driver



Traffic Interference at Points of Bridge Work Must Be Avoided and Slow Orders Kept to a Minimum

has been almost entirely supplanted by the steam hammer and the derrick car is gradually being replaced by modern locomotive cranes. Such cranes, equipped with steam hammers, are being used for driving piles, particularly concrete piles, on account of their greater capacity.

Handling Materials

Where there is a sufficient amount of material to be handled to warrant, a small gasoline crane with transverse wheels to enable it to be taken off the track at the bridge site, may be employed to advantage. While this crane does not require a work train, it does require a pilot, a conductor, and a locomotive engineer on most roads today to comply with labor agreements; and that feature may preclude its use because of additional expense.

While not used extensively, such off-track equipment as cranes and shovels may be employed in excavating, handling material, driving piles, and other work. The greater utility available from off-track machines, where they can be adapted, tends to speed up the work and shorten the periods during which slow-orders may be necessary. Where a sufficient depth of water is available, floating equipment may also be advantageous in eliminating traffic restrictions.

The motor truck has done a great deal to eliminate train service in handling material. Whether a work train is used or the material is unloaded from a regular train, there is usually some interference with traffic which may not be necessary if a truck is available. With present highways, a truck can now reach many of the structures and can be used to advantage, unless a sufficiently large amount of material is involved to warrant train service.

Developments in the use of the cutting torch and of acetylene and electric welding have done much to speed up bridge work. The cutting torch is invaluable to steel erection crews in carrying out their maintenance programs and can be used to advantage by bridge crews, particularly for cutting bolts, providing proper precautions are taken to prevent fires. While welding has not been developed to the point where it is accepted universally, it is being used extensively for miscellaneous repairs to steel bridges. Its use is readily adapted to repairs to plates and connections where members are not subject to high stresses.

The use of welding in making repairs to the machinery of movable spans should be considered. One road reports that by this means it built up bearing surfaces of gears in drawbridge machinery and thus eliminated the necessity of replacing the gears, which replacement would have required restricted speed over the structure.

Treated timber has been a very considerable factor in reducing traffic delays, by reason of its longer life and less frequent renewals. With the development of treatment has come a trend toward preframing and boring to increase the life of the timber still further. While not adopted universally by all railroads, the majority of them are using preframed timber to some extent, with considerable saving in the time required for its application thus cutting down the period during which restrictions to traffic may be necessary.

Much has been accomplished in the practice of placing culvert pipes in fills without the necessity for open trenches and falsework. Soil conditions permitting, pipe up to 72 in. in diameter can be jacked efficiently and pipe in excess of this diameter may

be placed by tunnelling without appreciable disturbance of the roadbed or interference with traffic. Concrete pipe chosen for jacking operations should be tongue-and-groove, rather than bell-and-spigot type. Jacking of pipe requires no special equipment except suitable jacks of sufficient capacity; but care must be taken to provide well-constructed back stops against which the jacking is done in order that there will be no failure while the work is in progress which might permit the pipe to "freeze."

Precast masonry is used to a greater extent than ever before to reduce traffic delays or slow orders. Precast culverts, slabs, blocks or bridge decks can be installed in a few hours without appreciable traffic delays. The amount of falsework is also reduced as well as the length of time that that portion of the track is under restricted speed.

In general, the placing of permanent bridges of concrete or steel design, or their remodeling or renewal, requires the greatest consideration in the elimination of traffic interference. In nearly all instances, the installation of falsework or the diversion of traffic is necessary and the procedure must be studied carefully before the work is started and temporary structures or tracks well maintained in order that maximum safe speeds may be maintained.

Where falsework is used, it should be designed of sufficient strength for normal speed, if possible. During installation, inequalities in surface due to heaving while driving piles must be corrected immediately. Further attention to falsework after installation will, no doubt, be necessary; and it should be watched carefully by the foreman in order that corrections will be made to line and surface, as demanded by traffic conditions.

In multiple track territory, it may be found advisable to divert traffic through the use of temporary or existing cross-overs. This expedient will slow traffic down to some extent, except in restricted zones, for the reason that the maximum speeds permissible will be governed by the turnouts. Even when using high speed 1-in-20 turnouts, the permissible speed should not exceed 40 miles an hour.

The use of run-around tracks is adapted especially to places where slow speeds would otherwise be required for long periods of time. If well constructed and of proper curvature, traffic diversions should permit speeds up to 60 miles an hour. Such speeds can, of course, be attained only by throwing a track to the temporary alinement and avoiding the use of turnouts. Constant vigil by track and bridge and building forces in maintaining run-arounds is necessary to keep the new roadbed and structures in proper line and surface. Where a bridge is a considerable distance from a siding and too much time is lost in clearing trains, the construction of a temporary spur track should be considered as a means for reducing the time required for carrying out the work.

Concrete Piling

The concrete pile is being employed extensively for the replacement of timber structures; and, in some instances, for steel structures. The concrete piles have the advantage that, by varying span lengths, they may be driven and the work carried out with little or no falsework, regardless of whether the piles are to be used in single bents for concrete slabs or I-beams, or in multiple bents for piers on which to place girder or truss spans. In its earlier period, the concrete pile was made either square or

octagonal and of about 16 in. dimension, five or six piles being driven per bent, depending on the loads to be carried. On open deck bridges, the use of this number of piles requires the shifting of the chords for driving, with the result that the driving period is lengthened by the necessity for opening and closing the bridge. Such opening and closing increases greatly the time required for the job and makes slow orders necessary for long periods, which slow orders are unduly restrictive to traffic.

A number of roads have overcome the objectionable feature of having to shift chords by designing larger piles (of 24 in. dimension) and using three of these piles per bent, driving one between the chords and one outside of each chord. The use of the larger pile requires only that a section of guard rail be removed at each location and that sufficient drift bolts and spikes be pulled to permit the shifting of a few ties. The bridge can be made ready for traffic while the pile driver outfit is running to a siding to clear the train and the ties can be reopened again by the time it returns. Some heaving may develop from the driving, but this can be shimmed out readily without excessive traffic interruptions.

While substructure work can, for the most part, be carried on without excessive traffic delays, superstructure installation or replacement often presents problems which can only be solved by the greatest amount of study and ingenuity in the development of methods, if the work is to be done within the limits permitted by train schedules.

Short spans—concrete slabs or steel that is easily handled—can usually be placed without interrupting traffic, providing sufficient consideration has been given to preparation. All adjustments possible must be made beforehand to avoid unnecessary shimming and lining during the work so that, on multiple span structures, the track can be closed to permit trains to pass without interruption of schedules. If adjustments will be required to connect new work to the old structure, this must be known in advance and the necessary men and material made available to handle the closure promptly.

Most roads have, for many years, been following the practice of placing long spans by erecting them on falsework alongside their final location, from which place they are rolled into place. In using this method, the deck and rails can be placed beforehand so that the track is out of service a minimum of time. With careful preparation for the movement and thorough study of train movements, little, if any, traffic interruption should result.

One road recently replaced two 246-ft. through truss spans with 89-ft. 6-in. deck plate girder spans on new concrete piers on a moderately heavy traffic line. After thorough study, the steel was erected by first placing the girders alongside the track between the trusses. The floor system was then removed, the girders lowered into place and the deck applied. This procedure was followed until all the girders were in place. The dismantling of the trusses was then begun, brackets having been applied to the girders to support the chords of the trusses. All of this work was carried out on a very definite schedule and, through the co-operation of the operating department, without a single interruption to traffic.

Conclusions

It is evident that much has been accomplished in the revision of working

practices to eliminate interference with traffic through careful study of the conditions to be overcome, the design of the structures, providing workmen with improved equipment and tools, furnishing better and more durable materials, and the proper and efficient handling of the field work. In spite of our accomplishments to date, we can look to the future and anticipate still more exacting requirements, for it is a foregone conclusion that further increases in speeds will be in order when the war is ended and our country takes up again where it left off on December 7, 1941.

DISCUSSION

President Crites: We will now be pleased to have a discussion of this report, bringing out any points or questions that members would like to raise.

C. Miles Burpee (Ry. Eng. & Mtce. Cyclopedia): This report is a fine example of the thinking, the work and the efforts that our committees have put forth this year to give us something that we can take back to the remainder of the men in our own organizations; practical suggestions of how to carrry on our work under these times of stress.

In referring to the jacking of pipe, the committee makes particular reference to the care that must be taken to provide well-constructed back-stops against which the jacking is done, in order that there will be no failure while the work is in progress, which might permit the pipe to freeze. That thought might be carried just a bit further. Speaking from experience, I believe that when you are opening up the trench, and before you start the jacking process, careful consideration should be given to the soil, particularly if you are using a corrugated pipe. More particularly, consideration should be given as to whether it is necessary to make the jacking process continuous; that is, not to interrupt it at the end of the day's work, but carry it forward in a second and third trick in order to keep the pipe moving continuously.

I know of some instances where special soil conditions have interfered with the jacking, and, while those conducting the work provided good back-stops, etc., when the gang came back on the job the following morning, the pipe was frozen, and regardless of the pressure that was applied with the jacks, nothing could be done to move it. In fact, I have seen one or two installations where they made an accordion out of the pipe in attempting to push it from one end. The result was the excavation had to be started from the opposite side of the fill and a second section of the pipe jacked from that side in order to complete the job.

I think that this is one further consideration which should be mentioned in connection with this report with respect to methods of doing work to prevent delays.

Chairman Lamport: I think Mr. Burpee has made a very good point.

S. T. Corey (C. R. I. & P.): I would like to ask about the truss spans mentioned in the report. Do I understand the girders were separated, one on one side and one on the other?

Chairman Lamport: That is correct. They were assembled after

the spans were placed on the piers.

Mr. Corey: I would like to call your attention to a similiar job on the Rock Island. Some years ago, we replaced a number of 150-ft. through lattice truss spans with 75-ft. deck plate girder spans, constructing piers at the centers of the old spans. First, the new steel, riveted up completely, was placed on cars and brought out on to the old truss span. Cross beams were then placed between the top chords of the trusses, the new steel spans were raised, the old truss floor was removed, and the spans were lowered to the new and old piers. The old trusses were then supported by bracing from the new deck plate girder spans and were ultimately removed after traffic had been restored. The old steel floor was dropped into the river in sections, the location of the sections in the river being maintained for their subsequent removal, by fastening ropes to them. I do not recall now whether any traffic delays were involved in this work.

President Crites: Is there any further discussion that will be helpful to eliminating traffic delays in carrying out bridge work? Mr. Lamport, I want to thank and congratulate you and your committee for a very able report.

Securing Maximum Utilization of Work Equipment

Report of Committee

D. T. Rintoul (*chairman*), general bridge inspector, S. P., San Francisco, Cal.; H. I. Benjamin (*vice-chairman*), vice-chairman system insurance, S. P., San Francisco, Cal.; W. F. Martens (*vice-chairman*), general foreman bridges and buildings, A. T. & S. F., San Bernardino, Cal.; H. W. Church (*vice-chairman*), general supervisor bridges and buildings, C. & O., Richmond, Va.; F. E. Taggart, assistant engineer, I. C., Chicago; F. G. Campbell, assistant chief engineer, E. J. & E., Joliet, Ill.; B. J. Chamberlin, scale supervisor, C. & E. I., Danville, Ill.; John S. Vreeland, associate editor, Railway Engineering and Maintenance, Chicago; J. E. Hogan, assistant division engineer, C. & O., Hinton, Va.; S. H. Knight, supervisor work equipment, N. P., St. Paul, Minn.; and J. D. Holmes, supervisor bridges and buildings, N. Y. N. H. & H., New Haven, Conn.

D. T. Rintoul
Chairman

Railroad operation presents problems today that are more difficult and complicated than any ever before faced by maintenance men. War conditions have resulted in an unprecedented volume of traffic which must be handled without interruption or delay. Manpower, particularly that skilled in maintenance work, must be used judiciously because of its scarcity. Some materials are not available for maintenance work, even if priorities are obtained, which fact results frequently in the necessity for using substitute materials for repair work. Many types of mechanized work equipment cannot be purchased and the best possible use must, therefore, be made of the equipment that is available, even though much of it may be obsolete. Equipment must be maintained in the very best condition so that it will involve no serious breakdowns or interruptions to the work.

To add to this problem, the depression years preceding this war left their mark on the railroads. Many structures that, in ordinary times, would have been completely renewed, have been kept safe and continued in service by making repairs, even though this was not "long run" economy but was merely postponing major work that would have to be performed later. This repair or "patchwork" has added to the present problem and the conditions are now such that the practice of "repair" work must often be continued.

Programming the Work

The conditions under which the railroads are operating at the present time, and the necessity of getting the greatest continuous use from equipment make the annual bridge inspection more important than ever. On this inspection there must be de-

termined not only the work that is to be performed, but also when it should be done. Work must be planned in an orderly way, if present equipment is to be used to the utmost and movement from job to job must be held to a minimum. In other words, equipment should be assigned to the jobs of the longest duration, thus reducing, wherever possible the time lost in moves between smaller jobs. In addition, maintenance of structures work should be planned whenever possible, so that it can be accomplished by methods that do not require the use of work equipment, thus conserving the equipment available for work that cannot be undertaken without its use. This may mean going back to methods in effect years ago, but which may prove of advantage under present circumstances.

Interruptions to traffic and slow orders must be avoided today more than ever before, and work must be planned in such a way that they will be kept to a minimum. Division and system maintenance and engineering officers have the responsibility of planning the larger items of work, but the bridge and building supervisor usually has the responsibility of seeing that the proper tools and mechanized equipment are on hand.

Classes of Equipment

Mechanized or power equipment can be divided into three classes—(a) "On-track" heavy equipment, such as pile drivers, locomotive cranes, ditchers and even outfit and motor cars; (b) "Off track" heavy equipment, such as crawler cranes, bulldozers, compressors, etc., and (c) small power tools, such as jackhammers, paving breakers, power drills, saws, etc.

The use of "on-track" heavy equipment, under present day traffic conditions, should be restricted as much as possible. The "on-track" pile driver, when not in use, should be stationed at one of the principal shop areas of a division, to be sent out only when needed by a gang. Like the relief derrick, a pile driver must be kept in good mechanical condition, ready for use in any emergency.

The locomotive crane greatly assists a depleted gang in handling heavy materials and in doing pile driver jobs or clamshell work. When a crawler crane is not available, it is often necessary to use a locomotive crane, but, in that event, there should always be a spur track available close to the work so that the crane may clear the main line quickly and not interfere with traffic. When not in use, a locomotive crane should be employed in a material yard.

The crawler crane is a valuable unit, since it can be kept clear of the track. When sent to a job it should be loaded on a flat car, together with slings, chains, nets, clamshells and a ramp for unloading, so arranged that they can be unloaded with the least possible delay.

Assigning Heavy Equipment

In assigning heavy equipment to gangs, consideration must be given to the greatest possible use of the various machines. Forces working on steel bridge repairs should be provided with the complete outfit necessary to perform the work most efficiently. System gangs that erect or dismantle steel bridges, make heavy masonry repairs, do extensive temporary trestle or falsework construction or out of face renewals of large timber structures, must be provided with cranes for handling heavy materials as well as for driving piling. Attention must be given to scheduling the work at times when train movements will interfere the least.

The concrete mixer is an "off-track" unit and in assigning such equipment, mixers of the proper capacity should be used, depending on the size of the job. A mixer too large or too small is uneconomical. It is seldom that any jobs performed by maintenance forces require more than a seven-sack mixer and in many cases a one-sack or four-sack mixer has been found most valuable. It is the function of the bridge and building supervisor to determine what size will be most economical and to ship this mixer to the gang as needed. It is important that the mixer be cleaned after each day's work and that it be kept in good running condition.

Air compressors, like concrete mixers, should be available in various capacities in order to secure maximum efficiency. Although it is only in recent years that the compressor has come to be recognized as a valuable general utility tool, it has now become indispensible. If possible, the compressor should be transported by truck rather than by train. On some railroads one or more compressors are mounted on a truck and assigned to the bridge and building department. Mounted in this manner together with a few air-operated tools, hose and accessories, and going from job to job as assigned, this tool will soon save its cost. This manner of transportation is a practice which contractors use to advantage and one which the railroads might well follow to obtain greater flexibility in the use of road tools. Because compressors, in conjunction with various air tools and equipment, can be used for excavating, tamping, boring, hoisting material with an air hoist, painting, cleaning, riveting, pile driving, operating pumps and jets, and many other uses, they have become one of the most valuable units in an outfit.

Numerous Types of Small Air-Operated Tools Are Standard Equipment in Many Bridge and Building Gangs

One noteworthy advancement in the equipment used by a bridge and building gang is the water pump. Old timers will recall the cumbersome and inefficient pumps that were formerly used; in comparison, the modern compact direct-connected and self-priming pumps are very satisfactory. Small, portable gasoline motor-driven trench pumps are an important aid to the modern bridge and building gang. These pumps should range in size from 2 in. up to 4 and 5 in. They are easily transported and while their use, of course, is restricted to the pumping of water, their utility has given them a greater field of service than was formerly the case. This equipment is interchangeable so that a gang can readily secure a pump of the proper size by exchanging with another gang.

Smaller equipment, such as jack-hammers, paving breakers, air augers

and spades, has established its place in the list of necessary equipment. The greatest difficulty with such equipment is in procuring it and in keeping it readily accessible for use when required.

The air spade is indispensable for tunnel work and drain tunnel work because of its light weight and ease of handling in overhead work. It can be used both as a spade and as a gad.

The motorized or air auger does the work of ten hand-operated augers under normal conditions. Such savings in time and manpower are of the greatest importance in renewing bridge decks quickly and thereby avoiding slow orders.

A power cut-off saw will save at least two-thirds of the man-hours formerly required in this work.

Air Tools

The air hoist has many uses, such as handling materials. It is frequently used in tunnel work for pulling out muck cars and buckets. Air hoists having a capacity of 1,250 lb. at 80-lb. air pressure and using 225 ft. of 5/8-in. cable have been found invaluable for placing bracing, caps, etc., under bents and spans or in dismantling steel spans or falsework timber. The capacity of the air hoist may be increased by using small steel blocks.

Each division should have its allotment of compressors, mixers, generators and air-operated tools, but it is not advisable to pool a large number of small tools for too much time is lost in transporting these tools from a central location, parts become mislaid or lost in transit and frequently an entire shipment is badly delayed, depriving a gang of its use meanwhile.

A close check of gangs should be made frequently by the supervisor to determine what tools are idle or may be idle in the near future, so that they may be sent to gangs where their use is required.

Operation of Equipment

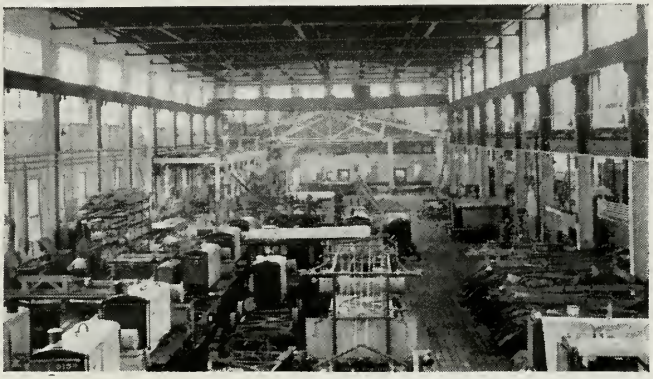
The proper operation and care of work equipment are essential to its maximum utilization. Capable operation carries with it minor details of every-day maintenance that, if promptly cared for, will prevent failures, with their resultant delays, and will increase the efficiency of the machine and prolong the periods between shopping for general repairs. Among these details of operation are correct lubrication, frequent inspection, the adjustment of moving parts as required and tightening loose bolts and nuts. The operator should have sufficient knowledge of the construction of the machine to detect readily any irregularity that might interfere with its operation and enough mechanical ability to make minor repairs and adjustments required to forestall breakdowns.

Some operators of work equipment have sufficient mechanical ability to make any field repairs that may be made by a regular maintainer. As a rule, however, the majority of the operators that are selected from a gang of bridge or sectionmen are able to handle only the minor details of operation. It is these details, however, that are responsible for failures of work equipment. For example, many failures arise because of fuel and ignition troubles; with the widespread use of the automobile, it should not be difficult to select a man from the gang who is familiar with these and other details of operation, which, if handled properly, will reduce failures and unnecessary repairs.

Maintenance of Equipment

The provisions for repairs probab-

ly comprise the most important factor in insuring maximum efficiency of tools. This is particularly true today in view of existing limitations on securing new equipment. In the 1941 Proceedings of this Association, a committee report on the Maintenance and Repair of Bridge and Building Equipment covered the subject fully, but because of its importance at this time, your committee feels that it should be reviewed again.



Much Time-Consuming Repairs in the Shop Can Be Minimized by More Maintenance in the Field

The rules and instructions that govern the maintenance of heavy machinery, such as shovels, cranes, pile drivers, draglines, etc., are the result of years of experience accumulated by men handling this type of equipment. Copies of these rules should be given to and be understood by each operator responsible for the operation and field maintenance of a machine. These operators should report every ten days on the condition of the machine and repairs needed.

Lubrication

Machinery is usually lubricated with standard greases and oils supplied by the stores department, which should have a list of the various machines and the types of grease and oil they require. Special oils and greases are necessary for certain special machines and should be covered by instructions to both the operator of the machine and the stores department. If the standard list is departed from on the orders placed by the operator, the requisitions should be referred to the supervisor of work equipment.

The operators of cranes and other cable-operated equipment should be responsible for turning the cables end for end to change the locations of points receiving the greatest wear. These operators should make periodic inspections to determine when the cable should be turned. They should also watch traveling clutches and other points on the machines which are subject to wear so that corrections can be made before breakdowns occur.

The supervisor of work equipment or one of his assistants should make an inspection of such equipment every 60 days for the purpose of checking the operator on the upkeep of the machine and to determine the manner in which the operator is conducting his work.

Machines should be shopped when the accumulated wear is such that field repairs will no longer assure

continued operation. There is no specified time that a machine should be operated before shopping occurs. Machines should be completely dismantled when sent to the shop for repairs. This will disclose any additional repairs that may be needed. The work list of repairs that is sent in with the machine by the operator or by division authorities is usually incomplete and additional repairs and overhaul are usually necessary.

It is the responsibility of the shop to turn out a first-class repair job on any machine sent in for overhauling and unless a machine is completely dismantled and thoroughly reconditioned, successful operation cannot be assured. Boiler repairs on steam-powered units are usually handled by the motive power department, as they comprise specialized work requiring a skilled boiler maker and the use of tools that are not available to maintenance of way forces. Also many state laws require that boiler makers perform all work on pressure vessels of any kind.

Compressors, gasoline engines, concrete mixers, etc., as a rule, do not fail unless an accident occurs, breaking some part. Their efficiency, which is lessened as a result of continual wear, determines whether a unit should be sent in for general repairs. This also holds true for air tools and other small units.

When air tools of this type (including tamping guns, paving breakers, jackhammers, etc.) are sent in, the consumption of air should be checked before the tool is dismantled. This will provide an indication of excessive wear or of poor valves and will give the mechanic a clue as to the trouble he may look for when the tool is dismantled. By means of special tools and measurements, he can then verify what repairs are needed. The repair of this type of equipment necessitates having replacement parts on hand.

The repair of tractors requires special tools, which are usually furnished by the manufacturer. In order to lessen the man-hours required on a repair job, the shop should be equipped with such tools. The shop should also be equipped with the necessary machine tools; blacksmith equipment, including a power hammer for light work; a crane for handling parts, and the tools necessary for reboring cylinders, regrinding valves and line-boring bearings.

From the reports made by equipment operators every ten days, a list of each piece of equipment, its location, and the work it is performing, can be compiled. This list should then be given to all officers who may be interested in the location of the equipment in order that its use may be scheduled most effectively. Likewise. in case of an emergency, any of these officers may refer to this list to determine the availability of almost every type of company equipment.

Conclusions

Summing up, the principal factors essential to maximum use and efficiency of work equipment in bridge and building work are: (1) The careful planning of the work, based upon an annual inspection, so that maximum use may be made of the equipment; and (2) the maintenance of the equipment in a good state of repair, as breakdowns are costly and faulty equipment leads to poor work.

DISCUSSION

President Crites: I am sure you will all agree that we have just heard an exceptionally fine report. The committee is certainly to be congratulated upon the way in

which it has prepared this report. I know you will now want to discuss this subject, giving the benefit of any experiences you think might be helpful to others.

L. R. Lamport (C. & N. W.): In the report where reference is made to water pumps, the statement is made that "their use, of course, is restricted to the pumping of water." In a number of instances we have pumped oil with these pumps. For example, last January we had a derailment and spilled a couple of cars of fuel oil, which was very thick at that time of the year. We sent a pile driver out to provide steam to thin this oil, which had flowed into pools in a small village near their water supply, and then we hooked up two 3-in. self-priming portable pumps in multiple and pumped several carloads of this oil back into the tank cars. They worked very satisfactorily.

President Crites: Ordinarily, when we speak of pumps, we think of their handling water, because pumps were first used for that purpose. We do not realize that they can be used also for pumping other fluids.

Is there any further discussion? If not, I want to take this opportunity to thank you Mr. Vreeland and your committee for the splendid report that you have prepared.

Carrying Over Bridges and Trestles

Report of Committee

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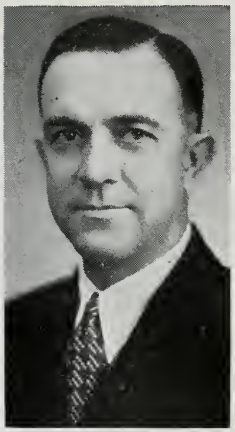


H. T. Livingston
Chairman

Railway bridges and trestles are carried over primarily for two principal reasons: (1) lack of money, and (2) lack of materials and labor. While we may not be confronted now with a lack of money, we do face shortages of both labor and materials and must exercise the greatest ingenuity in utilizing the materials and labor that are available in order to keep our railways in proper condition for operation.

The decision as to the methods to be used in carrying over any particular structure must take into account safety, a reasonably long life, and minimum cost. This will avoid the use of construction details that are poorly adapted to the needs and obviate the necessity of frequent inspections and frequent return of the bridge crew.

Bridges may be classified into three general types: (1) permanent bridges, (2) culverts, and (3) trestles.

Permanent Bridges

The selection of the method to be used in carrying over permanent bridges and trestles to avoid their immediate reconstruction depends upon the conditions that exist within the structure. The proper procedure may include any of the following: (a) placing the superstructure on falsework or supporting bents, (b) strengthening the superstructures in place by adding reinforcing steel, (c) replacing the superstructure with second-hand spans, strengthened, if necessary, (d) placing helper bents to take the load from the substructure, and (e) repairing or reinforcing the substructure to increase its service life, where warranted.

(a) Deck plate girder spans may be strengthened by driving pile piers or erecting frame bent piers on proper bearings at their centers, or adjacent to abutments and piers. The location of the temporary piers will depend upon the character of the stream and the amount of drift it carries. When through plate girder spans or through riveted truss spans are placed on falsework, it is usually necessary to drive the bents on the regular pile

trestle spacing, permitting the blocking under the steel stringers or floor beams to be placed upon the falsework stringers where most convenient. Where it is inadvisable to place such a large number of bents in the stream, wider bent spacing may be used and I-beams substituted for the wood stringers. If the panels of the truss are very long, say 20 to 30 ft., and the steel stringers rate above the proposed loading, bents may be driven each side of the floor beams and blocked to take the load.

Strengthening Existing Spans

(b) Steel spans may be carried over by strengthening in place. This may be done in many ways, depending upon the type of span. Careful study is involved in determining the best method of strengthening, and some ingenuity must be exercised in its selection. Many spans may be found to be too old or with details too poor to warrant strengthening. The material may be iron or Bessemer steel with a low yield point, and may require the addition of so much metal and the strengthening of such a large number of members as to make the cost prohibitive, particularly if the allowable increase in future loading is small. However, the strengthening of steel spans in place presents such attractive opportunities for economical carryovers that extensive investigation should be made before a decision is reached to replace them with new spans.

Deck plate girder spans may possibly be strengthened by splicing the web plates for bending if they were not so designed originally. This will add a few more square inches of flange section and, in some cases, materially increase the capacity of the spans. If the girders cannot be strengthened sufficiently in this manner, the practice is to add cover plates.

Flanges of stringers, floor beams, and girders of through plate girder spans and stringers and floor beams of truss spans may be strengthened in the same manner. Attention must be given to the connections and, where the number of rivets is insufficient, the old rivets should be removed and the holes reamed for larger rivets.

The strengthening of truss spans is much more complicated on account of the large number of members which may require strengthening. Side plates may be riveted to the webs of chords and web members of riveted trusses. The strengthening of pin truss spans presents considerable difficulty, particularly in those cases where eye-bars must be replaced with heavier ones, or with others of the same size but with metal of higher yield point. Here the entire span must be placed on falsework and the new pins and eye-bars inserted.

Old pin spans often develop loose eye-bars due to pin wear. In such cases, the eye-bar may be cut, shortened, and spliced or may be heated, upset, and thus shortened sufficiently to take up the slack. New and heavier counters may be applied by means of loop rods passing around the pins and connected to the center portions of the new rods, fitted with yokes.

Through truss spans may be strengthened by building in an auxiliary chord between the old trusses and fastened to the bottom flanges of the floor beams near their ends. Heavier bottom laterals are provided and connected to the auxiliary chord at either side of the floor beams, in the usual manner, with gusset plates. This auxiliary chord is designed to relieve the old chord from stresses produced by wind and sway, but each chord will, of course, be stressed by both horizontal and vertical forces, the dis-

tribution of which is more or less indeterminate.

A member of this committee advises of a rather unusual project that his railroad has under way in which a bridge consisting of five 135-ft. triple intersection truss spans is being strengthened by constructing a pier under the center of each span. This involves the placing of new end posts, portal bracing and pedestals, the strengthening of old web members affected by the shear changes and the reinforcing of stringers and floor beams by welding on additional metal. When this work is completed, this bridge, which is now rated E-30, will accommodate E-60 power. This railroad has also strengthened deck and through plate girder spans by constructing piers at their centers, and incidentally relieving the old substructure of heavy reactions.

Use of Second-Hand Spans

(c) Many railroads have accumulated both light and heavy second-hand spans which have been removed from service for various reasons. These constitute an extremely important source of supply, from which may be drawn a large proportion of the requirements for re-use, and thus obviate the purchase of new steel. These spans are constantly being utilized by either strengthening or alteration, or are released for scrap. Even when cut up for scrap, parts are utilized in innumerable ways wherever possible.

A case in point is furnished by a western railroad. A long deck plate girder span was cut in two at its center to make two shorter spans of much higher rating, and a girder span 6 ft. deep was shortened and cut to a depth of 4 ft. This was accomplished by making a longitudinal cut in the web, removing the flange from the discarded portion of the web and forcing this flange on the shallower web, which had been drilled previously to match the holes in the flange.

Old deck plate girder spans have been made over into through spans by providing new floors and old through spans have been made into deck spans, the old floors being discarded for scrap.

Old truss spans with narrow clearances have been widened to standard clearance by remodeling the old floors or by furnishing new ones. The committee has a record of one 150-ft. truss span whose clearance was widened under traffic. In this instance, the old floor beams were lengthened and strengthened, the trusses were strengthened and new portals and top and bottom laterals were provided.

While the utilization of old steel spans, whether in stock or under track, may not be considered technically as coming within the category of a carry-over, the result is the same in effect, in that the expenditure of larger sums is deferred, and, of equal importance at this time, the purchase of new steel is avoided, assuming priorities can be obtained.

Helper Bents

(d) With deck and through plate girder spans, pile or frame piers can be placed in front of the abutments or close to the piers and the girders blocked on them, thus relieving the masonry of a part or all of the reaction of the span. It is often necessary to drive bents behind abutments and place one or more panels of deck, the timber stringers spanning the bridge seat and being blocked on the falsework pier. The stringers must, of course, be placed low enough to clear the end floor beam, if any.

Where truss spans must be wholly supported at abutments or piers, a

sufficient number of piles must be grouped directly beneath the trusses and behind the abutments in line with the trusses and I-beams, placed from the front to the rear in groups beneath the shoes of the span. The shoes are then blocked up on the I-beams. This arrangement necessitates removing parts of the backwalls, and possibly some parts of the bridge seats, to permit insertion of the I-beams. When the old substructure is replaced, the new concrete may be built to bridge seat elevation, except for the space occupied by the beam sets. When the falsework I-beams are removed, the grillages are slipped into the recesses, concreted in, and the spans lowered. No live load should be permitted on the span while it is supported on the blocking.

This method has been used many times, but in every case the substructure has been rebuilt immediately after the falsework was placed. However, there is no reason why the reconstruction may not be deferred for a reasonable period, provided the falsework is built substantially.

The U-wings of old stone abutments may show evidences of incipient failure, indicated by cracks at the junctures between the shafts and wings. To guard against possible collapse, it may be necessary to drive one or more panels of trestle behind the abutment or tie the wings together.

Substructure Work

(e) It often becomes necessary or advisable to make substructures safe against further deterioration. Very commonly, stone masonry must be pointed to prevent moisture from penetrating the interior, where, through frequent freezing and thawing, considerable damage may be done. Cracked face stone may be removed and replaced with concrete. However, where the deterioration has progressed to a point where pointing or minor repairs are no longer adequate, other methods must be employed.

Old stone masonry in pedestals, piers, and abutments may be grouted by drilling holes at intervals and pumping grout in under pressure. This will force out any water which may have permeated the interior. This method has been used by two eastern railroads, one of which has two very long bridges, one 900 ft. and the other 1,200 ft. long, in which the substructure is of stone and is failing under the shoes. However, the pressure grouting method is being used effectively in these cases to preserve the substructures until it becomes necessary to rebuild those portions whose life may not be thus prolonged indefinitely.

Many old stone abutments were built with U-wings, some of them very massive. When incipient failure is noted, the driving of falsework behind the abutment may be avoided if reinforced buttresses are built against the outer surfaces of the wings opposite each other, in pairs, and tied together with reinforced concrete members connecting their tops. These ties should be located several feet below sub-grade, and should be designed as beams to resist bending moment caused by the distributed live load and also to resist the lateral forces which are communicated to it by the wings. The wings of several abutments treated in this manner have been preserved for twenty years without showing any signs of further failure.

Culverts

Prior to 1900, many stone arches and stone boxes were constructed, particularly on new lines. Some were paved but many were not. In some cases an occasional stone strut was

built between the side walls to neutralize the horizontal pressure at the footing. Some boxes were built with stone tops laid on the sidewalls and others with steel rails embedded in Utica cement. The wings usually were straight for boxes, but flared wings were common on arches. The foundations, as a rule, were without piling, resting upon whatever soil happened to lie immediately below the stream. In many cases the footings were at shallow depths and inadequate in area for modern heavy power. Many of these arches and boxes are still in fair condition after a half century of service, but, owing to some of the defective characteristics of the material used in their construction, difficulties are encountered in maintaining them.

Methods of Repair

Many of these structures have been undermined more or less because of the absence of the paving or of inadequate paving. Where there is indication of scour, a plain or reinforced concrete paving should be laid the full length of the box or arch and an apron wall of proper depth built between the ends of the wing. Even fairly large rip rap laid throughout the box or arch may prevent a bad washout.

When stones show signs of weathering at the joints, they should be thoroughly pointed to prevent moisture from penetrating through the walls. Occasionally cover stones will crack under load or through temperature changes. If the filling above the box is shallow, it may be removed and the stones replaced by a reinforced concrete cover or a sufficient number of second-hand rails may be placed and embedded in concrete.

If the fill is deep, rails may be placed below the stone cover, with their ends inserted into the sidewalls. This involves considerable labor to break out the stones to a sufficient depth to permit placing the rails.

A more permanent solution, providing the area of the present opening is somewhat larger than the requirement for the drainage area, is to line the structure with reinforced concrete on top, sides and floor. This involves some difficulty in placing the concrete but it may be accomplished by placing the forms for a short distance at a time and ramming the rather dry mixture in from the open end of the form. In some instances where the box is small, the reinforcing bars may be omitted, thus enabling the concrete to be placed much more easily.

Lining Arches

Large stone arches have been lined very successfully by placing a shell 12 in. to 18 in. thick, heavily reinforced. If the arch is in good condition other than showing some signs of developing weakness here and there, the weak places should be protected against further deterioration by pointing or grouting.

Another widely-used method consists of lining the arch with steel plates resting either upon the old footing toes or on new bench walls, sometimes built as high as the spring lines. These new bench walls should have foundations properly designed to support the reactions from the liner plates in case the old arch ring should fail.

A more recent method of restoring old masonry and deteriorated concrete has been developed for use particularly in walls, arches, and tunnels. The deteriorated surfaces of the exposed stone or concrete are removed and the stone joints cleaned out. Forms are then built, leaving several inches between the face of the masonry and the back of the form. This space is filled with small gravel, pipes are inserted through the forms and

cement grout is forced in through the pipes under considerable pressure. The grout is treated with chemicals to eliminate shrinkage. This method is applicable in problems of major restoration where the structure has failed from leakage, poor concrete, unstable filling, or locomotives' fumes in tunnels. It is reported that a very long tunnel on a western railroad was restored in this manner.

Pile Trestles

The maintenance of pile trestles comprises a problem of equal, if not greater, importance than that of permanent bridges. Some railroads have many more trestles than permanent bridges, and their aggregate length is much greater.

The vulnerable part of a pile trestle is the piling. However, as one committee member states, trestles may usually be carried over indefinitely if there are good piling below the ground level. His office, a few years ago, made a very exhaustive study of various methods used in repairing pile bents, specifying the particular lines and the particular territory where each of nine methods should be used. Four of these plans involve the insertion of various types of blocking beneath the caps, whereby a single pile may be blocked or a pair blocked. In all cases the blocks are toe-nailed.

The remaining plans contemplate stubbing at or below the ground line and splicing above the ground. Some of these methods are not recommended on certain lines, while others have been superseded by the practice of replacing the entire bent with a framed bent resting upon a sill set a sufficient distance below the ground line to insure that the supporting cut-off piling of the old bent is sound. This same method is used by another road on branch lines, by which means it almost entirely eliminates the driving of pile bents. Where the pile bents are quite high and have only four piles, or where the trestle is on a curve, additional posts are inserted beneath the chords and new batter piles are driven to reinforce the old piles and stabilize the bent.

An Eastern railroad, when replacing pile bents that have reached the renewal stage, excavates around the piling to below the water line and removes all of the decayed outer timber. Two ¾-in. dowels are then driven through the pile and a concrete footing poured entirely around the bent, the neat portion being carried up between the piles to the desired elevation. The neat work is boxed around the old piling and when the concrete has set, the old piles are cut off at the top of the footing course. A frame bent, previously framed, is then erected on the neat work and the boxed out recesses filled with concrete, thus sealing the tops of the old stubs.

Another Eastern railroad, in renewing deteriorated bents, places a falsework sill, blocked up from the ground level, on each side of the old bent and parallel thereto. Cross blocks are then placed perpendicular to the plane of the bent and between the piles, their ends resting upon the two falsework sills, after which the old piles are cut off above the ground at the proper elevation and another sill slipped under them. Excavation is made for the new concrete pedestals, and the pile stubs are cut off below ground water level.

The concrete pedestal is then poured to the pre-determined elevation below the sill supporting the old bent, and after it sets, a pre-framed bent is erected, following the removal of the old bent.

A large amount of material is

needed to enable a road to carry over bridges, as the necessity now develops. Large savings in time and money may be made by utilizing good second-hand material. Every individual concerned with the handling of recovered bridge material should make a conscientious effort to conserve it with a thought of future use by his own department or by others. Squared-edge, second-hand timber or second-hand treated pile ends may be used in building or repairing frame bents, good treated or untreated stringers may be used to replace decayed stringers or inserted in light chords to strengthen them. Worn but good ties may be turned, stringers, ties and caps that are too short for re-use as such, may be cut for blocking or treated for use in constructing wood box culverts. Similarly the engineer of buildings, the water service department and others contemplating carrying over structures other than bridges, wherein the quick procurement of steel angles and plates is important, may find large stocks of usable materials of this character in the second-hand steel bridge stock. All recovered material, whether of timber or steel, should be inspected carefully by competent individuals, and lists of usable materials furnished all who may be able to utilize them and avoid ordering new.

It is manifestly impossible to cover all of the innumerable phases of this subject of carrying over railway structures in a report of this length. The important thing is to give each problem mature and exhaustive consideration before making the final decision as to what shall be done.

DISCUSSION

President Crites: You have just heard a comprehensive report. I am sure, however, that there are few in the room who, from their experience of the last 10 or 12 years in carrying over bridges and trestles cannot add something constructive to what has already been presented. We shall be very glad to hear from you at this time.

F. G. Campbell (E. J. & E.): The report, as President Crites has said, is certainly comprehensive and exhaustive. It has mentioned almost every type of repair that one might think of as necessary to carry over our old bridge structures. However, I wonder why no mention is made of welding in the repair and strengthening of steel bridges.

Vice-Chairman Corey: I believe that welding is referred to in the report. In any event, it is quite essential to weld on cover plates in strengthening I-beams—oftentimes, stringers and floorbeams. Of course, this has to be done with great care and the personal equation of the welder must be watched closely.

Mr. Campbell: That is true, but I think with the developments in welding, and with the class of welders that many of us have at the present time, welding can be used extensively in bridge repairs, not only in applying cover plates, but also in the renewal of gusset plates, stiffeners and other parts of the fabricated structures.

J. S. Hancock (D. T. & I.): One of our most difficult problems is the renewal of treated timber pile trestles. We began to treat bridges about 1924. However, we did not treat the piling heavily enough so we are experiencing trouble with these treated piles. We have found that the best way to determine the condition of the piles is to take off

the cap and examine the piling at the top, because the trouble usually starts there. In this way, we can determine the condition of each pile and decide whether to repair the individual piles or to frame the bent. This works out all right except where the bents are in a stream which carries heavy drift. We are in doubt about the safety of such bents. We have not found a satisfactory way of anchoring these framed bents to the cut-off of the old piles.

Welding

We have done considerable welding. I think welding is entirely practicable. We have reinforced some old truss spans by welding, and find that in the pin-connected trusses the actual stresses in the lower chord members are not as great as the calculated stress because the floor system acts as a part of the lower chord.

Vice-Chairman Corey: Some years ago we developed plans to strengthen some bridges on one of our important lines. For members having riveted cover plates we cut holes in the new cover plates to fit over the old rivet heads and then plug welded in these holes to attach the new cover plates to the old plates and rivet heads. The procedure was criticized by a welding expert, who recommended plug welding in slotted holes along the center of the cover plates, and intermittent welding along the outer edges of the new cover plates; also intermittent welding of existing cover plates to their framing members in the locations where the calculated rivet stress in the reinforced member was too high.

Mr. Campbell: Was that welding arc or gas welding?

Vice-Chairman Corey: Arc welding. Mr. President, I would like to make a suggestion. You know that this is an inexhaustible subject; that it is not possible to treat it properly in such a discussion. It seems to me there are so many things individual roads have done about which others have no information, that it would be very helpful if we made it a practice to exchange information more generally than we do. These meetings serve this purpose admirably but, of necessity, in general terms only. It seems to me it would be a good thing to have a kind of clearing house to pass along such information

President Crites: Mr. Corey, in the American Railway Engineering Association we are endeavoring to carry out your suggestions on wood bridges and trestles. I have worked on that subject for a year, but it is difficult to get the suggestions turned in.There is so much information possessed by the group on the floor that we should attempt to develop this subject here, and get it into the hands of our members in a short time. That is what this meeting is for; to develop anything that will help our members through the advice and experiences of others. The bridge and building men follow established practices more than blueprints, and so any thoughts we can get here today will be well received and well worth our while.

J. L. Varker (D. & H.): We have abutments and piers that we have strengthened by permeating, that is, grouting. A year ago we started

this practice, and fixed up two structures. This year we have repaired half a dozen or more. Next year, we intend to do another half dozen. This method, with which you are more or less familiar, is internal grouting. The grout is pumped in under considerable pressure. The masonry is predrilled and tested, after which the exposed faces are Gunited to seal up all the cracks and voids. Then the internal grouting is done.

It has been our experience that this is quite successful. We have resorted to this method of permeating and it has eliminated the hazard of maintaining old abutments so we do not have to tear them out and put in new ones. I think it has some merit as far as maintaining the masonry of bridges is concerned.

Use of Strain Gages

Mr. Campbell: Mr. President, Mr. Hancock's remark that the lower chords of trusses are not always subject to the stress one might think from observation, brought to mind one railroad in the East that has a very large bridge problem—it is a rather small railroad but has a number of important bridges. This road is using strain gages quite extensively in its investigations and these have sometimes shown that members which they thought were being overstressed were not, and that those that they expected were not being overstressed were. This road no doubt has saved a considerable amount of money in its bridge repairs, and has been able to carry over bridges that it had not expected to carry over. I do not believe that this type of investigation is being used as extensively as it might be.

President Crites: I agree that this is a good thought. In the case of lattice trusses, I do not know how the bridge engineer would figure the stresses without a strain gage. Have any of you had any experience in carrying over structures by welding? That is something that we on the B. & O. are planning to do.

A. E. Bechtelheimer (C. & N. W.): Electric arc welding is being used extensively in strengthening old bridge spans, also in general repair work. The Erie, the Chicago, Milwaukee, St. Paul & Pacific and the Chicago and North Western have done such work. I am sure there are many others.

I wish to go back to Mr. Hancock's pile bridge problem in the early part of this discussion and make this suggestion. Where it is necessary to frame bents in swiftly flowing streams, or where there is moderate drift, considerable protection can be obtained by driving new batter piles in these bents, then framing inside of these and bracing the whole bent as a unit. For a five-pile bent, piles 1 and 5 are cut off at framing level to permit driving the batter piles close in and in the same position under the caps as piles 1 and 5. The five old piles can then be frames, using four posts. This arrangement gives a six-member bent—two piles and four posts—framed and braced as a unit.

President Crites: Mr. Corey, your committee did a most excellent job and we are indebted to you for the presentation of the report.

Salvaging Bridge, Building And Water Service Materials

Report of Committee

H. W. Wuerth (*chairman*), division engineer, C. M. St. P. & P., Savanna, Ill.; E. H. Barnhart (*vice-chairman*), division engineer, B. & O., Garrett, Ind.; W. A. Huckstep (*vice-chairman*), general bridge supervisor, M. P., St. Louis, Mo.; Maxfield Bear (*vice-chairman*), estimator, C. & N. W., Chicago; John E. Bird, bridge and building inspector, N. Y. C., Corning, N. Y.; R. W. Cook, general bridge inspector, Seaboard, Norfolk, Va.; J. B. Lodeski, assistant general bridge inspector, C. & N. W., Chicago; G. L. Sitton, chief engineer, maintenance of way and structures, Sou., Charlotte, N. C.; M. P. Walden, assistant supervisor, bridge and building, L. & N., Evansville, Ind.; L. G. Byrd, supervisor, bridge and building, M. P., Poplar Bluff, Mo.; R. H. Morrison, superintendent, bridge and building, Bang. & Aroos. Houlton, Me.; and Alfred G. Rose, scale and bridge inspector, M. P., Osawatomie, Kan.

H. Wuerth
Chairman

The following statements are to be considered as applicable primarily to the conditions which the railroads face today in obtaining materials for new construction as well as for repair work. They also should be applicable, to a certain degree, during normal times. Our lumber supply is exhaustible; for that reason we must conserve it.

Salvaged or second-hand materials fall roughly into three general classes; i. e., (1)—those suitable for use in structures which are intended to serve a temporary purpose; (2)—those for use in structures intended to be continued in service indefinitely—material recovered is to be used in replacing similar material in like structures; (3)—that which will be sent to a mill or shop for sawing, milling or refabrication.

It must be borne in mind that all of the railroads have given a great deal of thought for many years to getting all the service possible out of timber and have used second-hand timber to a great extent. Today, with much of our lumber, hardware, water service material, etc., on the critical list, it behooves us to make greater use of second-hand materials than ever before. That is what we are all doing and it is certain that many a crew has been kept going this last year with salvaged material.

A proper slogan today is—*"Waste not, Want not."*

Bridge Materials

The careful and early planning of the season's bridge renewal and repair program can be very helpful in obtaining and utilizing good second-hand material for the season's work. By first working on the highest and longest bridges requiring out of face renewal, more suitable material will be recovered early in the working season for use in smaller structures. This fits in with a program whereby heavy renewals are made in the late winter, when little or no work can be done below ground line. Piles can be driven in the late fall or early winter and work on framing the deck can then be continued economically in deep winter as snow or freezing weather causes little interference with such work. Floors on long girder or truss spans

can be renewed economically in mid-winter. All this planning and execution of the work assure a generous supply of usable second-hand timber, consisting of pile stubs (new), second-hand piling, caps, stringers and ties. Brace planks and guard rails usually have little value except as blocking.

Piling—When redriving pile trestles, all new pile stubs or butts above cut-off are salvaged and can be used for many purposes in the work to follow. Their use depends on the lengths so salvaged.

Short pile stubs make excellent posts under freight house platforms, stock pen platforms and chutes (both loading and unloading) and under buildings of all kinds where the floor is at car floor height with post and sill construction underneath. Long pile stubs can be used for posts in frame bents in track bridges and in overhead highway bridges, especially in dump and shallow bents.

Old piling cut off at the ground line after a new bridge is placed in service can be used in a similar way as new pile stubs. In addition, because they are usually longer, they can be used as posts in replacing defective piles in bents and as posts in high frame bents in both track and highway bridges. Some use is made of them as fence posts by sawing them to seven or eight-foot lengths and then splitting them in quarters or eighths, depending upon the cross section of the pile. One railroad reports that salvaged cypress and cedar piling are sent to the mill for sawing into lumber and shingles.

Caps—Caps recovered in renewals in kind usually are not all in poor condition. Some can be reused as caps in replacements on secondary lines and as caps for temporary falsework. Others make suitable blocking in raising bridges. Still others can be cut up, eliminating the unsound wood, and used as corbels, short blocking or posts. In cases where long caps are renewed on pile piers under steel spans, standard caps for trestles can be sawed out of old caps and reused in cap renewal programs.

Stringers—Stringers recovered in renewals have many uses, depending on their condition. The better ones can be used as helper stringers, sometimes known as strengtheners. The next best can be used as backwall or bulkhead timber. Others can be sawed up, destroying the poor wood but using the short, sound pieces for

Every Effort Must Be Made to Salvage and Re-Use All Usable Bridge Steel and Timbers

blocking, sills under posts and frame bents. Many stringers can be reused as stringers in the construction of farm road and minor public highway bridges over streams that are maintained by the railroad.

Ties—Ties recovered from pile trestles or girder or truss spans in 8-in. by 8-in. or 8-in. by 12-in. sizes, 10 to 12 ft. long, can be reused in a season's work in many different ways. The better ones make excellent blocking, bulkhead timbers, floors on minor bridges (highway or private) over streams, timber retaining walls, sluice ways, linings or tunnels through embankments when placing pipe, etc. Bridge ties make excellent material for cribbing at washouts, for they are light and easy to handle. It is important that poor ties be culled out and only the better ones kept for the work in hand.

All Timber and Piling—All timber and piling recovered from bridges renewed in kind, after the sound timber is picked out, have another potential value. They can be milled to sizes that can be utilized for building work—stock pens, platforms, concrete form bracing, shoring, blocking and for innumerable other purposes, in addition to use in the sizes recovered. All sound timber which cannot be used in repair programs should be sent to a central point where it can be sawed into dimension lumber. All salvaged material must be inspected carefully for termites. Under no circumstances should it be shipped elsewhere if infested with that pest.

Hardware—Packing, drift, guard rail and brace bolts should be sorted carefully and the scrap material discarded as scrap while the usable bolts are reused. Packing bolts will possibly require rethreading before reuse; others can be cut up and made into machine bolts. Still others can be remade into drift bolts. All packing washers (cast) must be saved and reused where practical. O. G. and recess washers must be saved. In bygone days much of this kind of material was carelessly thrown or dropped into rivers and creeks. Today it is not only good practice to save it as it may not be available in new material allotments on account of priorities, but it is also patriotic to save and collect scrap and we certainly do not want to run short of scrap.

Steel Girders and Trusses—In the salvaging of steel girder and truss bridges, much has been accomplished on many railroads in reusing light steel structures on secondary lines. The refabricating of girders for other uses has often been resorted to as new material was not available. Girders have been disassembled and the recovered materials used for strengthening and repairing other girders and trusses in track.

Building Materials

Much is being accomplished by various railroads in recovering and reusing building materials. Large, cumbersome (in many cases two-story) combination freight and passenger depots are being torn down and, with the help of some new finished lumber, smaller and more modern depots are being built. In many cases second story living quarters for either station help or section help are no longer used as living quarters. When vacant, such places become a fire hazard as well as a catch-all for the storage of materials that should be either used or sent to storage points where it will be visible to the eyes of the alert supervisor. Other facilities, such as roundhouses, stock pens, freight platforms, coal and oil houses, when retired and removed, build up large stocks of usable materials for making repairs to similar structures.

In recovering and reusing building materials, there is a great opportunity not only to devise more economical salvaging methods, but to exercise ingenuity in finding uses for everything that can be salvaged. Careful dismantling will produce much usable lumber in the larger dimensions, such as sills, joists, rafters, studs, girts, etc. The lumber so recovered is just as good as, if not better than the new material now furnished.

When dismantling a building, each member should be removed carefully and nails withdrawn. The materials should then be placed in piles according to dimensions, scrap and usable being separated. Any decayed or damaged ends of boards or timbers should be cut off and burned during the dismantling operations. In many instances it has been found possible to obtain quantities of nails from salvaged lumber, which are suitable for reusing in smaller structures. All nails, spikes or bolts not suitable for reuse should be sent to the scrap bin.

Millwork, such as doors and door frames, windows and window frames and sashweights, if found in satisfactory condition, can be recovered and reworked into other buildings. General hardware, such as locks, latches, hinges, etc., affords an opportunity for badly-needed critical material to be obtained from salvage operations. Roofing materials, such as asbestos, tile or metal shingles, can be salvaged and reused by the exercise of proper care.

When designing a new building, much thought must be given to the materials available from salvage operations. It often happens that heavier members can be sawed into lumber of smaller dimensions—for

The Two-Story Brick Building (Below) Was Remodeled Into a Modern One-Story Station and Office Building (Above)

example, 4-in. by 4-in. studs to 2-in. by 4-in. studs, 2-in. by 8-in. rafters to 2-in. by 4-in. studs, and 6-in. by 8-in. and 8-in. by 12-in. timbers into 2-in. by 8-in., 3-in. by 8-in., 2-in. by 12-in., 3-in. by 12-in., etc., joists or rafters. As a rule the new design of the depot will call for concrete foundation walls and floor, which releases all the heavy floor timbers, beams, joists and floor plank.

One of the accompanying illustrations shows a remodeling job before and after, in which a two-story brick building was remodeled into a modern one-story station and office building. Lumber and brick recovered in the dismantling were used almost exclusively in the finished structure. In another case, a freight house was remodeled, the new roof covering being entirely of asbestos shingles recovered from various dismantled buildings.

Another outstanding example of effective remodeling is the case of a present small snug wayside freight and passenger depot, which was constructed from materials recovered in dismantling an old large, oversize freight and passenger depot. The structure before remodeling was 24 ft. 6 in. by 74 ft. in area, on a post foundation, with a floor area of 1812 sq. ft. After remodeling, the depot is 16 ft. by 38 ft., on a concrete foundation, with a floor area of 608 sq. ft. Wall plates, studs, rafters, roof boards, sheathing, V'd ceiling and the freight room floor were recovered from the old depot and reused. Not only has this road now a new depot, built with 75 per cent of the lumber second-hand, but it has a depot only one-third as large to maintain.

Again, as with salvaged bridge lumber, materials must be inspected carefully for termites; termite-infested material should not be shipped to non-infested areas.

Water Service Materials

Much of the material used in railroad water service work is on the critical list, so that every effort should be made to salvage and reuse such material, not only in the interest of economy but as a patriotic duty in the present emergency. It should not be necessary to enumerate all the items of materials and equipment that may be salvaged and reused as is, or after reconditioning, but some of the larger and more important items are as follows:

Pipe and Fittings—The salvaging of abandoned underground pipe lines and fittings has been promoted extensively within the last year. Cast iron, as well as wrought iron pipe in 4 in., 6 in., 8 in. and 10 in. sizes have been salvaged, in many cases at costs less than the present market prices. Other operations of this kind cost more but new pipe is not available on account of priorities. When the wrought iron pipe is found pitted, the poor sections are cut out and scrapped and the good pieces welded together to provide required lengths for the repair or renewal of other lines.

Much steam, water and gas pipe, with fittings, has been recovered from abandoned buildings and reused for repair work. Almost all types of hot water and steam radiators can be reassembled in units of the sizes needed for heating purposes. Boilers, fittings and accessories, hot and cold water pressure valves, relief valves, steam traps, etc., are susceptible to salvage and repair with good parts from similar equipment. To a somewhat lesser degree, the same is true of plumbing fixtures and fittings. Entirely new assemblies have been made from such salvaged materials.

Many gate valves are salvaged, which require only cleaning and oiling. Globe valves are shipped to shops

for reseating and changing out discs.

Water Tanks—Water tanks, when renewed, usually release hoops, staves and floors, which can be reused either for repairs or for the construction of new tanks. When the threaded ends of hoops are in poor condition, they can be reconditioned by cutting them off and welding on new pieces to be rethreaded. In some cases, recovered staves and floor lumber can be reused by cutting them down to the lengths required for smaller tanks used in bridge and building or extra-gang camp outfits. Tank spouts, with fixtures and outlet valves, are salvaged and reused.

Water columns, where replaced with larger columns or retired, should be sent to a central point or storehouse where they can be reconditioned and sent out again as needed. Much has been accomplished with the efficient welding facilities that we now have. Water column stands and bases, when broken, can be kept in service by welding. This is true also of the water jackets of pumps and engines, and the bases for motors and engines.

Electrical appliances, such as starter switches, automatic control devices, etc., all critical, can be repaired with parts taken from salvaged appliances. However, care must be exercised when reusing wire and conduit to comply with fire underwriters specifications.

DISCUSSION

President Crites: Mr. Huckstep, your committee is to be congratulated. You have presented an excellent report on a very important subject. The report is now open for discussion.

S. T. Corey (C. R. I. & P.): I would like to ask Mr. Huckstep how far north termites have been noted.

Vice-Chairman Huckstep: There are some 1900 varieties of termites in the world and, if I recall correctly, about 127 varieties in the United States. There are only 3 which you are likely to come in contact with, that is, the powder post termite, the dry wood termite, and he subterranean termite. The subterranean termite builds its nest below ground, near water. Termites were first found some years back in the Southern states, along the Gulf and along the seaboard. They gradually worked North and six or seven years ago there were a few states in the Northwest that had them. Today, there is no state in the United States that does not have termites. We find them working in Nebraska, Iowa, Kansas and down through the Mississippi valley. They inflict great damage. Recently, I had a call to go south to look at a passenger station built more than 30 years ago. We had thought it was a brick station but found it was brick veneer. It had a concrete foundation and a concrete floor. The brick veneer was secured to the boxing of the outside walls by metal clips. The termites had eaten the studs clear up to the plates; also most of the lath behind the plaster.

I have seen roundhouses where the trusses were just on the point of collapsing, because termites had eaten up inside the columns. However, if employees are on the alert, they will see them swarm in the spring and the fall, particularly about May.

President Crites: Are there other questions on this subject? If not, we thank your committee and thank you very much, Mr. Huckstep.

Maintaining Coaling and Sanding Plants to Meet Today's Requirements

Report of Committee

Committee—A. L. McCloy (*chairman*), supervisor, bridges and buildings, P. M., Saginaw, Mich.; B. F. Francis (*vice-chairman*), supervisor, bridges and buildings, N. Y. C., Jersey Shore, Pa.; P. L. Koehler (*vice-chairman*), division engineer, C. & O., Ashland, Ky.; F. R. Spoffard (*vice-chairman*), bridge and building supervisor, B. & M., Boston, Mass.; L. Clapper, assistant chief engineer, D. M. & I., Duluth, Minn.; D. W. Converse, assistant engineer, A. C. & Y., Akron, Ohio; L. A. Cowsert, water inspector, B. & O., Dayton, Ohio; V. E. Engman, chief carpenter, C. M. St. P. & P., Savanna, Ill.; W. K. Manning, general foreman, Erie, Cleveland, Ohio; L. R. Thompson, supervisor, bridges and buildings, M. & St. L., Oskaloosa, La.; H. D. Tubbs, resident engineer, P. & M., Detroit, Mich.; H. A. Wistrich, assistant chief engineer, L. V. Bethlehem, Pa.; and J. F. Zanolio, master carpenter, D. & R. G. W., Grand Jct., Colo.

A. L. McCloy
Chairman

This subject is a very important one. With our country at war and the railroads loaded almost to capacity, and with demands growing greater every day, coaling stations and sanding plants are facing more exacting demands than ever encountered before. Dependable coaling and sanding plants reduce the dispatching and road time of trains. More care than ever must be given therefore to keeping these plants in good operating condition. Rigid rules covering the inspection, operation and maintenance of these plants should be set up and strictly adhered to. Operators must be on the alert to detect any defects which may cause interference with their operation and report them immediately for adjustment or repair.

The bridge and building department must realize and accept its part in the teamwork necessary to meet the unprecedented demands thrown upon the railways of America to provide railway facilities of unquestioned dependability in every phase of operation and maintenance. Long-standing familiarity with the maintenance of coaling and sanding plants by the bridge and building forces has so far stood the acid test of performance on the job.

Coaling Stations

When the last report on coaling and sanding plants was presented to this Association in 1916, a wide variety of types of coaling plants were in service, including the primitive type where coal was shoveled into buckets and unloaded into the locomotive tender with a crane; the type where a car of coal was run up a trestle onto a high dock and the coal shoveled into pockets, with a coaling gate on the front side of each pocket to release the coal to the locomotive; and the chain link belt type of station.

Concrete coaling plants were then in their infancy, but with years of study and research these plants have been developed until they are now adequate if properly maintained.

They have given good service year after year, although there may come a time when large repair expense will begin to develop. In various coaling plants of this construction, it is found that the parts that most commonly require renewal are those steel parts that are cast in the concrete. These include particularly the steel delivery chutes which pass the coal through the openings in the bottom of the concrete bin. These parts are so inaccessible that the only method of renewal or repair is to build them in the opening by welding, which is inconvenient and costly.

This difficulty does not apply to all designs of coaling plants for some chutes are bolted against the face of the concrete, with anchor bolts cast in the concrete. For this type, complete renewals may be purchased and placed without much delay.

Some coaling plants have undercut gates on their delivery chutes where non-skim-type gates may be preferable.

The requirements of coaling and sanding plants are almost as varied as their locations, and for this reason the local operating and mechanical personnel, as well as the bridge and building supervisory officers who will have the responsibility for the upkeep of at least the structural parts of such plants, should be consulted before construction or alteration is undertaken. If this is done, the inspection, operation and maintenance of each individual plant can be scheduled and planned in advance.

Inspection

The inspection of coaling plants is one of the most important factors in the maintenance of this type of machinery. The maintenance of coaling plants is a divided responsibility. Where electric power is used, the electrician is responsible for the electrical appliances and, where gas or fuel oil engines are employed, the mechanical or water service department is responsible for the appliances; but in either instance structural repairs come under the bridge and building department. The mechanical department usually operates the plant.

Inspection should start at the bottom of the pit. See that coal is kept cleaned out in order that the counterweights and bucket bars have proper clearance to permit the feeder box gates and locking bar to function. Inspect all anchor bolts cast in the concrete to see that they are not rusting off.

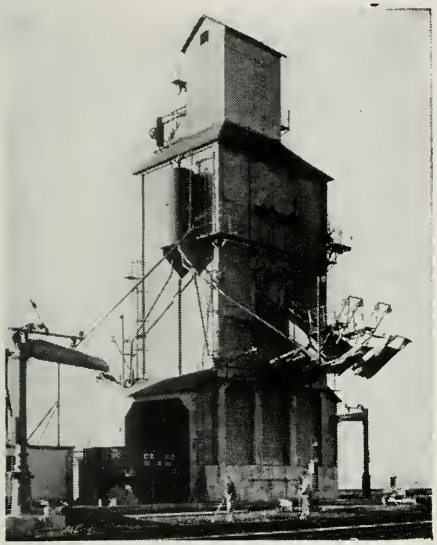
See that feeder box supports under the lower end of the box are in good condition. There have been instances where, in the original construction, a wooden block was placed to support the lower end of the feeder box and after several years this block rotted, transferring all the weight of the coal and box on to the cast iron door frame through which the coal runs from the pit into the feeder box. This caused the door frame to break, allowing the feeder box to fall into the pit, which resulted in serious delay to operations at this point while making repairs.

Check the cable for broken strands; also cable chip fastenings. See that coal dust is not accumulating under the undercut gates. In one case salt was sprinkled in the coal in the winter to keep it from freezing in the feeder box, and the salt and fine coal packed under the undercut gate to such an extent that the heavy concrete counterweight would not move. Instead, it broke off the four anchor bolts that held the cable sheave, with the result that the concrete had to be cut away from around the four bolts and bolt

studs welded on, which caused some delay in operation.

Inspect the counterweight and bucket cable for broken strands, and don't forget to examine the bolt and clevis on the bucket bail and counterweight bail, because failure of this clevis has been known to cause a long delay in operation as well as costly repairs.

It is not the intention of the committee to go into much detail with



Modern Train Schedules Require Careful Maintenance of Coaling and Sanding Facilities

regard to the inspection, but rather to mention items that are vital to the safety and operation of coaling plants. Sheaves and pins should be watched and renewed when they show wear. Where castings and parts are bolted on, the bolts are of vital importance as they will rust off, and may let the apron or some other part fall without warning, with the hazard of injury as well as delay to operations.

All removable parts should be taken off once a year and coated with an acid-resisting paint or plastic compound; bolt threads should be cleaned and oiled before the nuts are replaced. This procedure does not seem to be general practice on all roads, but during present times it can well prevent serious delays.

The track department should check the track and keep it level under the aprons. If the tracks are not level, locomotive tanks will not take coal evenly and some coal will roll off to the ground.

One more important item to keep inspected is the beams across dumping pits. If these are neglected until they require renewal, costly repairs are required. The men working about the coaling station should clean these beams every month and paint them with a very heavy oil to keep moisture off the steel. The committee suggests that if any such I-beams have not been checked recently, this check should be made in order to determine whether corrosion has weakened these members to a point where their safety might be involved. This has happened in many plants.

The factor, above all other factors, that determines whether a road is getting out of a machine everything that was built into it is the general care that is given it. Careless neglect of a machine is inexcusable. It curtails its life, increases the frequency and cost of repair and robs it of its dependability.

First in importance in the servicing of a machine is proper lubrication. Most manufacturers of coaling plant machinery realize the importance of this so fully that they spend much time and money to design the lubricating system of their equipment properly and then determine the best kind, quality and grade of lubricant for each particular part of the ma-

chinery. If the builder makes specific recommendations regarding the lubricant to use, it is only fair to him, to the machinery and to the railroad, that these be followed.

The petroleum industry has made marked advances in the development of lubricants and we can be assured of good results if we use the proper lubricants. Machinery should not be run until it develops noise in order to warn that it needs lubrication, but it should be gone over thoroughly at regular intervals and be well lubricated. Equipment should be kept clean. Although a coaling plant is subject to an accumulation of coal dust, this should be kept cleaned off as much as possible and not allowed to penetrate into the wearing parts. All parts subject to corrosion should be kept painted or otherwise protected to prevent deterioration. On most railroads it is the duty of the operator to see that the machinery receives the proper servicing and care. This feature should be checked frequently. Cleanliness is a good indication of proper care.

Sanding Plants

Some type of sanding plant is usually provided in connection with almost every coaling plant. Some are crude and others modern, but all of them have some type of sand drying stove or coils. In some of the older type, sand is shoveled into the sand dryer hopper and is then transferred into the sand dome of the locomotive with pails; in others, sand is shoveled into the dryer and then shoveled into a steel drum and elevated by compressed air to sand storage tanks, where it is finally drawn off by gravity into the sand dome of the locomotive. In the more modern type, sand is placed in hoppers above the sand dryer by crane and bucket and the dry sand runs by gravity into the steel drum, from which point it is elevated by air to the steel storage tank, which is usually located on a platform on the side of the coal dock, from which it can be drawn by gravity to the sand dome of the locomotive.

The problem of inspection and maintenance is very important as the sand drying stoves or coils have an important duty to perform. During the present war emergency, the demand for dry sand is greater than ever before, and the sand drying equipment has to be forced more generally to its capacity. This makes it necessary to make more frequent inspections of the grates, fire pots, etc. The pipes through which the sand is elevated to the sand storage tank are usually two inches in diameter. In the past it has been a problem to keep these pipes from being cut out by the sand blast effect of the dry sand travelling through them at so high a velocity. At one time it was thought that good service was obtained if the couplings on straight lines would withstand thirty days' use; while the two-inch ells would cut through in about two weeks. This cutting of the ells has been overcome to a great extent by replacing them with a tee to provide a sand cushion, or by long bends to reduce friction. For couplings, extra heavy pipe is being used; the top end of the pipe is beveled from the outside and the bottom end of the pipe is beveled from the inside, and the two ends are screwed into the coupling which forms a bevel joint. The sand flows through this joint without cutting. This type of joint will usually last about six months.

A number of articles have been written about the qualifications of foremen who have jurisdiction over

coal and sand plant operators, but they can be boiled down to this—he must know his job. A good foreman can size up his men and know where a pat on the back or stronger methods will do the most good. Both methods are necessary, but a good leader loves to praise and hates to punish. If good housekeeping is preserved and suggestions encouraged and given prompt attention, men will be proud of their job, and of their safety record.

Safety

The prevention of accidents constitutes a problem around any moving machinery; it is particularly true around coaling and sanding plants. Industry faces the problem of adequate man power; men who are entering new and unfamiliar jobs must be trained because the possibility of accidents is far greater in proportion than the increase in the number of persons employed.

Metal or other suitable guards should be placed around all moving parts of hoisting machinery and other units where there is danger of accidents. These guards should be so placed as not to interfere with the operation of the machine, but give the maximum protection to the operator. Grease and oils should not be allowed to accumulate on the floor where they might cause the operator to slip and cause injury.

Conclusions

Supervision is the prime requisite to the maximum use of coaling and sanding facilities with the least interruption or delay. Closer, more thorough and more frequent inspections are required to insure locating potential sources of trouble before actual breakdowns occur. The prompt correction of potential sources of trouble may avoid serious delays.

Cleanliness is a prime requisite in preventing interruptions, unnecessary wear and possible personal injuries.

Proper lubricants, in the right amounts, should be applied to parts subject to friction or wear. Too much oil or grease will cause accumulations which are fire and personal injury hazards.

Eternal vigilance and close cooperation between all parties responsible for the maintenance and operation of coaling and sanding plants are needed more at this time than ever before.

DISCUSSION

President Crites: Mr. McCloy, you are to be congratulated on this fine report. I think the conclusions are especially pertinent at this time.

MEMBERS REGISTERED AT THE 1943 CONVENTION

Altogether, 150 members and guests from roads widely scattered over the United States registered their attendance and took part in the convention. Following is a list of members who registered:

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Bardwell, R. C.
*Barham, R. Y.
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Bear, Maxfield
Bechtelheimer, A. E.
Brown, W. H.
Boyd, George E.
Burpee, C. Miles
Campbell, F. G.
Chapman, A. B.
Chinn, Armstrong
Clarke, H. R.
Corbyn, M. H.
Corey, S. T.
Crites, G. S.
Curie, H. D.
Day, E. G.
Dayton, F. W.
Dorland, Arthur G.
Dove, R. E.
Emquist, F. G.
*Filkins, A. J.
*Flanagan, Luke
Frazin, A.
Gehr, B. F.
Hancock, John S.
Hanley, J. P.
Harris, A. R.
Hauerslev, H. W.
Holmes, G. H.
Holmberg, V. V.
Howard, Neal D.
Howson, Elmer T.
Huckstep, W. A.
Hughes, C. A.
Johnson, Maro
*Keith, L. P.
Kerns, W. V.
Knowles, C. R.
Lamport, L. R.
*Lehon, Tom
Luck, Richard P.
Lyman, C. R.
Madson, Howard C.
Maisenbacher, P. F.
Masters, F. H.
Montzheimer, Arthur
McCloy, A. L.
McElhinney, H. A.
Powrie, W. G.
Putman, R. B.
Roof, W. R.
Sirel, Alex A.
Sloane, F. M.
Strate, T. H.
Tratman, E. E. R.
Vandenburgh, E. C.
Varker, J. L.
Vreeland, J. S.
Wall, E. G.
Watson, Walter
Weir, K. J.
Weise, F. E.
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President	F. E. Schall	A. E. Killam	J. N. Penwell	L. D. Hadwen
1st V.-Pres.	A. E. Killam	J. N. Penwell	L. D. Hadwen	G. Aldrich
2nd V.-Pres.	J. N. Penwell	L. D. Hadwen	G. Aldrich	G. W. Rear
3rd V.-Pres.	L. D. Hadwen	T. J. Fullem	G. W. Rear	C. E. Smith
4th V.-Pres.	T. J. Fullem	G. Aldrich	C. E. Smith	E. B. Ashby
Secretary	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Treasurer	J. P. Canty	J. P. Canty	J. P. Canty	F. E. Weise
Executive Members	G. Aldrich	G. W. Rear	W. F. Steffens	W. F. Steffens
	P. Swenson	W. F. Steffens	E. B. Ashby	S. C. Tanner
	G. W. Rear	E. B. Ashby	S. C. Tanner	Lee Jutton
	W. F. Steffens	C. E. Smith	Lee Jutton	W. F. Strouse
	E. B. Ashby	S. C. Tanner	W. F. Strouse	C. R. Knowles
	W. O. Eggleston	Lee Jutton	C. R. Knowles	A. Ridgway

	1915-1916	1916-1917	1917-1918	1918-1919
President	G. W. Rear	C. E. Smith	S. C. Tanner	Lee Jutton
1st V.-Pres.	C. E. Smith	E. B. Ashby	Lee Jutton	F. E. Weise
2nd V.-Pres.	E. B. Ashby	S. C. Tanner	F. E. Weise	W. F. Strouse
3rd V.-Pres.	S. C. Tanner	Lee Jutton	W. F. Strouse	C. R. Knowles
4th V.-Pres.	Lee Jutton	F. E. Weise	C. R. Knowles	A. Ridgway
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Executive Members	F. E. Weise	W. F. Strouse	A. Ridgway	J. S. Robinson
	W. F. Strouse	C. R. Knowles	J. S. Robinson	J. P. Wood
	C. R. Knowles	A. Ridgway	J. P. Wood	A. B. McVay
	A. Ridgway	J. S. Robinson	D. C. Zook	J. H. Johnston
	J. S. Robinson	J. P. Wood	A. B. McVay	E. T. Howson
	J. P. Wood	D. C. Zook	J. H. Johnston	C. W. Wright

	1919-1920	1920-1921	1921-1922	1922-1923
President	F. E. Weise	W. F. Strouse	C. R. Knowles	Arthur Ridgway
1st V.-Pres.	W. F. Strouse	C. R. Knowles	A. Ridgway	J. P. Wood
2nd V.-Pres.	C. R. Knowles	A. Ridgway	J. S. Robinson	J. S. Robinson
3rd V.-Pres.	A. Ridgway	J. S. Robinson	J. P. Wood	C. W. Wright
4th V.-Pres.	J. S. Robinson	J. P. Wood	C. W. Wright	E. T. Howson
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.			F. E. Weise	F. E. Weise
Directors	J. P. Wood	C. W. Wright	E. T. Howson	F. C. Baluss
	A. B. McVay	A. B. McVay	J. H. Johnston	Maro Johnson
	J. H. Johnston	G. A. Manthey	E. K. Barrett	O. F. Dalstrom
	E. T. Howson	E. T. Howson	F. C. Baluss	S. D. Corey
	C. W. Wright	J. H. Johnston	Maro Johnson	W. B. Hotson
	G. A. Manthey	E. K. Barrett	O. F. Dalstrom	P. N. Nelson

	1923-1924	1924-1925	1925-1926	1926-1927
President.....	J. S. Robinson	J. P. Wood	C. W. Wright	E. T. Howson
1st V.-Pres....	J. P. Wood	C. W. Wright	E. T. Howson	F. C. Baluss
2nd V.-Pres....	C. W. Wright	E. T. Howson	F. C. Baluss	Maro Johnson
3rd V.-Pres....	E. T. Howson	F. C. Baluss	Maro Johnson	J. S. Huntoon
4th V.-Pres....	F. C. Baluss	Maro Johnson	J. S. Huntoon	C. S. Heritage
Sec.-Treas.....	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.....	F. E. Weise	F. E. Weise	F. E. Weise	F. E. Weise
Directors	S. T. Corey	J. S. Huntoon	C. S. Heritage	A. I. Gauthier
	W. B. Hotson	A. I. Gauthier	W. B. Hotson	E. L. Sinclair
	P. N. Nelson	E. L. Sinclair	P. N. Nelson	O. F. Dalstrom
	J. S. Huntoon	C. S. Heritage	A. I. Gauthier	W. T. Krausch
	A. I. Gauthier	W. B. Hotson	E. L. Sinclair	R. C. Bardwell
	E. L. Sinclair	P. N. Nelson	O. F. Dalstrom	H. I. Benjamin

	1927-1928	1928-1929	1929-1930	1930-1934
President.....	F. C. Baluss	Maro Johnson	J. S. Huntoon	C. S. Heritage
1st V.-Pres....	Maro Johnson	J. S. Huntoon	C. S. Heritage	A. I. Gauthier
2nd V.-Pres....	J. S. Huntoon	C. S. Heritage	A. I. Gauthier	H. I. Benjamin
3rd V.-Pres....	C. S. Heritage	A. I. Gauthier	H. I. Benjamin	W. T. Krausch
4th V.-Pres....	A. I. Gauthier	H. I. Benjamin	W. T. Krausch	T. H. Strate
Sec.-Treas.....	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.....	F. E. Weise	F. E. Weise		
Directors	W. T. Krausch	R. C. Henderson	G. A. Rodman	E. C. Neville
	R. C. Bardwell	J. S. Ekey	W. A. Batey	H. H. Best
	H. I. Benjamin	T. H. Strate	F. W. Hillman	J. E. King
	R. C. Henderson	G. A. Rodman	E. C. Neville	A. B. Scowden
	T. H. Strate	W. A. Batey	H. H. Best	W. A. Batey
	J. S. Ekey	F. W. Hillman	J. E. King	L. C. Smith

	1934-1935	1935-1936	1936-1937	1937-1938
President.....	H. I. Benjamin	T. H. Strate	E. C. Neville	C. M. Burpee
1st V.-Pres....	T. H. Strate	E. C. Neville	C. M. Burpee	F. H. Masters
2nd V.-Pres....	E. C. Neville	C. M. Burpee	F. H. Masters	W. S. Lacher
3rd V.-Pres....	A. B. Scowden	F. H. Masters	C. A. J. Richards	C. A. J. Richards
4th V.-Pres....	W. R. Roof	C. A. J. Richards	W. S. Lacher	F. H. Cramer
Sec.-Treas.....	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Directors	C. M. Burpee	A. L. McCloy	W. R. Roof	B. R. Meyers
	W. A. Batey	R. P. Luck	T. P. Soule	G. S. Crites
	L. C. Smith	H. H. Best	F. H. Cramer	R. E. Dove
	C. A. J. Richards	W. R. Roof	B. R. Meyers	T. P. Soule
	A. L. McCloy	T. P. Soule	G. S. Crites	A. Chinn
	R. P. Luck	F. H. Cramer	R. E. Dove	L. G. Byrd

	1938-1939	1939-1940	1940-1941	1941-1942
President.....	Armstrong Chinn	A.E.Bechtelheimer	H. M. Church	R. E. Dove
1st V.-Pres....	F. H. Cramer	F. H. Cramer	R. E. Dove	F. H. Soothill
2nd V.-Pres....	A.E.Bechtelheimer	H. M. Church	F. A. Soothill	G. S. Crites
3rd V.-Pres....	H. M. Church	R. E. Dove	G. S. Crites	A. M. Knowles
4th V.-Pres....	R. E. Dove	F. H. Soothill	A. M. Knowles	N. D. Howard
Sec.-Treas.....	C. A. Lichty	C. A. Lichty		
Secretary.....	.....	.....	F. O. Whiteman	A. G. Shaver
Treasurer.....	.....	.....	F. E. Weise	F. E. Weise
Directors	L. G. Byrd	B. R. Meyers	N. D. Howard	R. E. Caudle
	W. R. Ganser	W. Walkden	L. G. Byrd	I. A. Moore
	F. H. Soothill	A. S. Krefting	K. L. Miner	W. A. Sweet
	B. R. Meyers	A. M. Knowles	R. E. Caudle	J. L. Varker
	W. Walkden	L. G. Byrd	I. A. Moore	L. E. Peyser
	A. S. Krefting	K. L. Miner	W. A. Sweet	Martin Meyer

	1942-1943	1943-1944	1944-1945	1945-1946
President.....	G. S. Crites	J. L. Varker		
1st V.-Pres.....	R. E. Caudle	R. E. Caudle		
2nd V.-Pres....	A. M. Knowles	N. D. Howard		
3rd V.-Pres....	N. D. Howard	F. G. Campbell		
4th V.-Pres....	J. L. Varker	J. S. Hancock		
Secretary.....	A. G. Shaver†	Elinor V. Heffern		
	Lorene Kindred‡			
	Elinor V. Heffern			
Treasurer	F. E. Weise	C. R. Knowles		
Treasurer Emeritus		F. E. Weise		
Directors	M. Meyer	W. F. Martens		
	L. E. Peyser	A. L. McCloy		
	K. L. Miner	L. C. Winkelhaus		
	F. G. Campbell	E. H. Barnhart		
	J. S. Hancock	A. B. Chapman		
	L. C. Winkelhaus	L. E. Peyser		

†To November 1, 1942
‡To February 1, 1943

NEW MEMBERS

July 1, 1943 — June 1, 1944

Adams, Lem
Cathon, Thomas M.
Clopton, Edward J.
Cronin, Matt
Downard, Robert
Dunnagan, Jesse P.
Eichenlaub, Carl M.
Gilmore, Robert W.
Haase, E. H.
Hackett, Coyt A.
Haines, Paul
Hughes, C. A.
Kahley, J. M.
Kirkpatrick, M. G.
Manley, Burleigh F.
Matthews, Wallace L.
Miller, Charles L.
McNally, Patrick F.
Olson, Gerhard
Osbourne, Terril D.
Pagels, Edward H.
Robinson, Noble R.
Smith, Joseph
Sullivan, Lora
Watson, Lyon W.
Welch, J. W.
Yaw, D. M.

LIST OF ANNUAL CONVENTIONS

No.	Place	Date	Membership	Enrollmem
1	St. Louis, Mo.,	Sept. 25, 1891	60	...
2	Cincinnati, Ohio,	Oct. 18-19, 1892	112	24
3	Philadelphia, Pa.,	Oct. 17-19, 1893	128	27
4	Kansas City, Mo.,	Oct. 16-18, 1894	115	38
5	New Orleans, La.,	Oct. 15-16, 1895	122	40
6	Chicago, Ill.,	Oct. 20-22, 1896	140	36
7	Denver, Colo.,	Oct. 19-21, 1897	127	43
8	Richmond, Va.,	Oct. 18-19, 1898	148	34
9	Detroit, Mich.,	Oct. 17-18, 1899	148	32
10	St. Louis, Mo.,	Oct. 16-18, 1900	143	45
11	Atlanta, Ga.,	Oct. 15-17, 1901	171	46
12	Minneapolis, Minn.,	Oct. 21-23, 1902	195	52
13	Quebec, Canada,	Oct. 20-22, 1903	223	65
14	Chicago, Ill.,	Oct. 18-20, 1904	293	104
15	Pittsburgh, Pa.,	Oct. 17-19, 1905	313	62
16	Boston, Mass.,	Oct. 16-18, 1906	340	81
17	Milwaukee, Wis.,	Oct. 15-17, 1907	341	91
18	Washington, D. C.,	Oct. 20-22, 1908	368	99
19	Jacksonville, Fla.,	Oct. 19-21, 1909	393	79
20	Denver, Colo.,	Oct. 18-20, 1910	428	117
21	St. Louis, Mo.,	Oct. 17-19, 1911	499	102
22	Baltimore, Md.,	Oct. 15-17, 1912	524	103
23	Montreal, Que.,	Oct. 21-23, 1913	570	100
24	Los Angeles, Cal.,	Oct. 20-22, 1914	586	126
25	Detroit, Mich.,	Oct. 19-21, 1915	665	159
26	New Orleans, La.,	Oct. 17-19, 1916	710	154
27	Chicago, Ill.,	Oct. 16-18, 1917	704	168
28	Chicago, Ill.,	Oct. 15-17, 1918	716	119
29	Cleveland, O.,	Oct. 21-23, 1919	776	196
30	Atlanta, Ga.,	Oct. 26-28, 1920	840	172
31	New York, N. Y.,	Oct. 18-20, 1921	850	207
32	Cincinnati, Ohio,	Oct. 17-19, 1922	865	167
33	Seattle, Wash.,	Oct. 16-18, 1923	846	140
34	Kansas City, Mo.,	Oct. 21-23, 1924	837	202
35	Buffalo, N. Y.,	Oct. 20-22, 1925	759	172
36	Richmond, Va.,	Oct. 12-14, 1926	750	155
37	Minneapolis, Minn.,	Oct. 18-20, 1927	754	224
38	Boston, Mass.,	Oct. 23-25, 1928	755	211
39	New Orleans, La.,	Oct. 15-17, 1929	755	200
40	Louisville, Ky.,	Oct. 21-23, 1930	713	147
41	Chicago, Ill.,	Oct. 16-18, 1934	592	153
42	Chicago, Ill.,	Oct. 15-17, 1935	547	139
43	Chicago, Ill.	Oct. 20-22, 1936	588	129
44	Chicago, Ill.,	Oct. 19-21, 1937	566	147
45	Chicago, Ill.,	Oct. 18-20, 1938	589	139
46	Chicago, Ill.,	Oct. 17-19, 1939	546	145
47	Chicago, Ill..	Oct. 15-17. 1940	610	167
48	Chicago, Ill.,	Oct. 14-16, 1941	594	141
49	Chicago, Ill.,	Oct. 20-22, 1942	618	119
50	Chicago, Ill.,	Oct. 20-21, 1943	597	68

CONSTITUTION

ARTICLE I.

NAME

Section 1. This association shall be known as the American Railway Bridge & Building Association.

ARTICLE II.

OBJECT

Section 1. The object of this association shall be the advancement of knowledge pertaining to the design, construction and maintenance of railway bridges, buildings and other structures, by investigation, reports and discussions.

Section 2. The association shall neither indorse nor recommend any particular devices, trade marks or materials, nor will it be responsible for any opinions expressed in papers, reports or discussions unless the same have received the endorsement of the association in regular session.

ARTICLE III.

MEMBERSHIP

Section 1. The membership of this association shall be divided into five classes, viz: Members, life members, associate, honorary and junior members.*

Section 2. A member shall be a person in a responsible position in connection with railway bridge and building work, or in the employ of a public regulatory body, a professor of engineering in a college, an engineering editor, or a government or private timber expert. Any person desirous of becoming a member shall make application upon the form prescribed by the executive committee, setting forth his name, age, residence and practical experience. He shall furnish at least three references to whom he is personally known. Applicants may be voted into membership at any regular executive meeting or by letter ballot of the executive committee, a majority vote being necessary in either instance.

Section 3. To be eligible for a life membership a member must have belonged to the association for at least ten years and in general must have retired from active railway service due to age or physical disability. He shall have all the privileges of active membership, except the holding of office, and shall not be required to pay annual dues. The transfer from membership to life membership shall be made in the same manner as the election of members, as prescribed in Section 2, of this Article.

Section 4. Associates shall be responsible persons who are not eligible as members, whose pursuits or attainments qualify them to co-operate with members in the study and development of improved practices in the construction and maintenance of bridges, buildings and water facilities. They shall have all the rights of members except of voting and holding office. They shall be elected in the manner prescribed for members, in Section 2, of this Article.

Section 5. Honorary members shall be chosen from persons who have attained acknowledged eminence in some branch of engineering or railway service. Their number shall be limited to ten. Honorary members shall be proposed by not less than six active members and shall be elected by the unanimous vote of the members present at a regular meeting. They shall have all the rights of active members except that of holding office and shall be exempt from the payment of dues.

*Amended October 16, 1941.

Section 6. A junior member shall be a person who is a graduate of a recognized engineering school, or who has been employed for at least two years in the design, maintenance or construction of railway bridges, buildings or structures. Applicants shall be at least 21 years of age and they shall be elected in the manner prescribed for members, in Section 2 of this article. Juniors shall have all the rights of members except that of holding office. When the attainments of a Junior are such as to qualify him as a member, he may apply for promotion and the Executive Committee shall authorize such promotion when qualifications warrant the action. Unless a Junior is promoted, his membership shall cease automatically when he becomes 28 years of age.*

Section 7. Any member guilty of conduct unbecoming a railroad officer and a member of this association, or who shall refuse to comply with the rules of this association, shall forfeit his membership on a two-thirds vote of the executive committee.

Section 8. Membership shall continue until written resignation is received by the secretary, unless member has been previously expelled, or dropped for non-payment of dues in accordance with Section 1 of Article VII.

Section 9. Only active members shall hold office in this association, and only active and life members shall be entitled to vote in the election of officers or selection of place for holding annual convention.

ARTICLE IV.

OFFICERS

Section 1. The officers of this association shall be a president, four vice-presidents, a secretary, a treasurer and six directors who with the most recent past president shall constitute the executive committee.

Section 2. The past presidents of this association, previous to the most recent past president, who continue to be members, shall be privileged to attend all meetings of the executive committee, of which meetings they shall receive due notice, and be permitted to discuss all questions and to aid said committee by their advice and counsel; but said past presidents shall not have a right to vote, unless called upon to fill a quorum.

Section 3. Vacancies in any office shall be filled for the unexpired term by the executive committee without delay.

ARTICLE V.

EXECUTIVE COMMITTEE

Section 1. The executive committee shall manage the affairs of the association and shall have full power to control and regulate all matters not otherwise provided for in the constitution and by-laws and shall exercise general supervision over the financial interests of the association, and make all necessary purchases and contracts required to conduct the general business of the association but shall not have the power to render the association liable for any debt beyond the amount then in the treasury and not subject to other prior liabilities. All appropriations for special purposes must be acted upon at a regular meeting of the association.

Section 2. Meetings of the executive committee may be called by a majority of the members of the committee, providing 10 days' notice is given members by mail.

Section 3. Five members of the executive committee shall constitute a quorum for the transaction of business.

ARTICLE VI.

ELECTION OF OFFICERS AND TENURE OF OFFICE

Section 1. Except as otherwise provided the officers shall be elected at the regular annual meeting of the association and the election shall not

*Amended October 16, 1941.

be postponed except by unanimous consent of the members present at said annual meeting. The election shall be by ballot, a majority of the votes cast being required for election. Any active member of the association not in arrears for dues shall be eligible for office, but the president shall not be eligible for reëlection.

Section 2.† The president, four vice-presidents, secretary and treasurer shall hold office for one year and the directors for two years, three directors being elected each year. All officers retain their offices until their successors are elected and installed.

Section 3.† The term of office of the secretary and the treasurer may be terminated at any time by a two-thirds vote of the executive committee. Their compensation shall be fixed by a majority vote of the executive committee.

The secretary shall also serve as secretary of the executive committee.

Section 4. The secretary and the treasurer shall be required to give bond in an amount to be fixed by the executive committee.

ARTICLE VII.

MEMBERSHIP FEE AND DUES

Section 1.† Every member upon joining this association shall pay to the secretary an entrance fee and dues as prescribed by the executive committee. No member in arrears for annual dues shall be entitled to vote at any election and any member more than one year in arrears may be stricken from the list of members at the discretion of the executive committee.

ARTICLE VIII.*

LOCAL SECTIONS

Section 1. Upon the application of ten or more members of the association residing in the same geographical district, or having offices therein, the executive committee shall organize a local section for that district, to which all members in that district shall be eligible. Such local section shall admit to active membership only members in good standing but may receive others into affiliate membership. It shall hold not less than two meetings each year, and shall be governed by such constitution and by-laws not inconsistent with the constitution of this association as the section membership may adopt and the executive committee of the association approve.

Section 2. The parent association shall not be put under any obligation, either financial or in the matter of policy or opinion, by any local section.

ARTICLE IX.

AMENDMENTS

Section 1. This constitution may be amended at any regular meeting by a two-thirds vote of the members present, provided that notice of the proposed amendment or amendments has been sent to the members at least 30 days previous to said regular meeting.

BY-LAWS

TIME OF MEETING

1. The regular meeting of this association shall convene annually on the third Tuesday in October at 10 a. m.

PLACE OF MEETING

2. The place of holding the next annual convention shall be selected by ballot at the annual meeting of the association. All the places proposed

†Amended October 17, 1940.

*Article adopted 1922.

shall be submitted to a ballot vote of the members present at the annual business session and the place receiving a majority of all votes cast shall be declared the location of the next annual meeting. If no place receives a majority of the votes cast, the place receiving the lowest number of votes shall be dropped on each subsequent ballot until a place is chosen.

3. It shall lie within the power of the executive committee to change the location or time of the meeting if it becomes apparent that it is for the best interests of the association.

QUORUM

4. At the regular meeting of the association, 15 or more members shall constitute a quorum.

DUES

5. The annual dues, for the fiscal year ending September 30, and payable in advance, shall be as follows:*

Members, $4.00; Associate Members, $3.00; Junior Members, $2.00.

DUTIES OF OFFICERS

6.† The president shall have general supervision over the affairs of the association. He shall preside at all meetings of the association and of the executive committee; shall appoint all committees not otherwise provided for, and shall be ex-officio member of all committees. He shall with the secretary sign all contracts or other written obligations of the association which have been approved by the executive committee. He shall render a detailed report at least three times during the year to the members of the executive committee, showing the financial condition of the association and its activities.

At the annual meeting the president shall present a report containing a statement of the general conditions of the association.

7. The vice-presidents in order of seniority shall preside at meetings in the absence of the president and discharge his duties in case of a vacancy in his office.

8.† It shall be the duty of the secretary to keep a correct record of the proceedings of all meetings of this association, and of all accounts between this association and its members; to collect all moneys due the association, and deposit the same in the name of the association. He shall pay all bills when properly certified and approved by the president and the treasurer, and make such reports as may be called for by the executive committee. He shall also perform such other duties as the association may require.

9.‡ The treasurer shall have charge of the funds, check all deposits as made by the secretary, sign all checks after they have been approved by the president, and invest all funds not needed for current expenses as directed by the executive committee. He shall report at each annual meeting on the condition of the finances.

NOMINATING COMMITTEE

10. After each annual meeting the president shall appoint a committee of five members, not officers of the association, of whom two at least shall be past presidents, and two of whom shall have served on the committee the previous year, which shall prepare a list of names of nominees for officers to be voted on at the next annual convention, in accordance with Article VI of the constitution, said list to be read at the first session of the second day of said convention. Nothing in this section shall be construed to prevent any member making further nominations.

AUDITING COMMITTEE

11.‡ Prior to each annual meeting the president shall appoint a committee

*Amended October 16, 1941.
†Amended October 17, 1940.
‡Adopted October 17, 1940.

of three members, not officers of the association, whose duty it shall be to examine the accounts and vouchers of the secretary and the treasurer and certify as to the correctness of their accounts.

COMMITTEE ON SUBJECTS FOR DISCUSSION

12. After each annual meeting the president shall appoint a committee whose duty it shall be to prepare a list of subjects for investigation to be submitted for approval at the next convention.

COMMITTEE ON INVESTIGATION

13. After the association has adopted the list of subjects for investigation the president for the succeeding year shall appoint the committees who shall prepare the subjects for report and discussion. He may also appoint individual members to prepare reports on special subjects, or to report on any special or particular subject.

PUBLICATION COMMITTEE

14. After each annual meeting the executive committee shall appoint a publication committee consisting of three active members whose duty it shall be to coöperate with the secretary in the issuing of the publications of the association. The assignment of this committee shall be such that at least one member shall have served on the committee during the previous year.

ORDER OF BUSINESS

15.† Call to order by president.
Opening prayer or invocation.
President's address.
Report of secretary.
Report of treasurer.
Appointment of special committees.
Reports of standing committees and presentation of papers.
Unfinished business.
New business.
Selection of place for next annual meeting.
Election of officers.
Installation of officers.
Adjournment.

DECISIONS

16. The votes of a majority of the members present shall decide any questions, motion or resolution which shall be brought before the association, unless otherwise provided. Unless specifically provided herein otherwise all discussions shall be governed by Robert's rules of order.

†Amended October 17, 1940.

DIRECTORY OF MEMBERS

As of July 1, 1944

Aagaard, P., 6826 S. Dante Ave., Chicago (retired).
Aaron, H. C., Supv., B. & B., W. M. Ry., Hagerstown, Md.
Adkins, H. O., Mast. Carp., D. & R. G. W. R. R., Grand Junction, Colo.
Ailes, Newton C., 64 Adams Place, Delmar, N. Y. (retired).
Aldrich, L. G., Br. For., N. Y. N. H. & H. R. R., South Braintree, Mass.
Alexander, L. B., Ch. Dftsman., M. C. R. R., Detroit, Mich.
Allen, G. A., Br. Inspr., C. & O. Ry., Clifton Forge, Va.
Allen, T. H., Supv. B. & B., C. & O. Ry., Hinton, W. Va.
Anderson, August, Gen. For. B. & B., L. S. & I. Ry., Marquette, Mich. (retired).
Anderson, G. F., For. B. & B., Sou. Pac. Co., Roseville, Cal.
Anderson, J. L., Supv. B. & B., M. P. R. R., Osawatomie, Kans.
Anderson, R. D., Div. Engr., C. & N. W. Ry., Huron, S. D.
Anderson, W. L., Office Engr., C. & N. W. Ry., Chicago.
Autcliff, R. L., B. & B. For., P. M., Edmore, Mich.
Azer, Wm. J., Asst. Supv., B. & B., C. & N. W. Ry., West Chicago, Ill. (retired).

Baker, F. A., Los Angeles, Calif.
Baker, R. C., Supv. B. & B., C. & E. I. Ry., Danville, Ill.
Baker, W. L., Br. Inspr., C. & E. I. Ry., Salem, Ill.
Ball, H. H.. Foreman, Can. Nat. Rys., Toronto, Ont.
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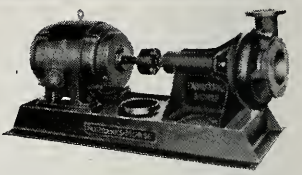

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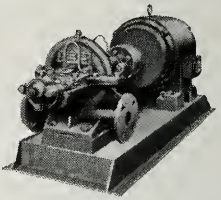

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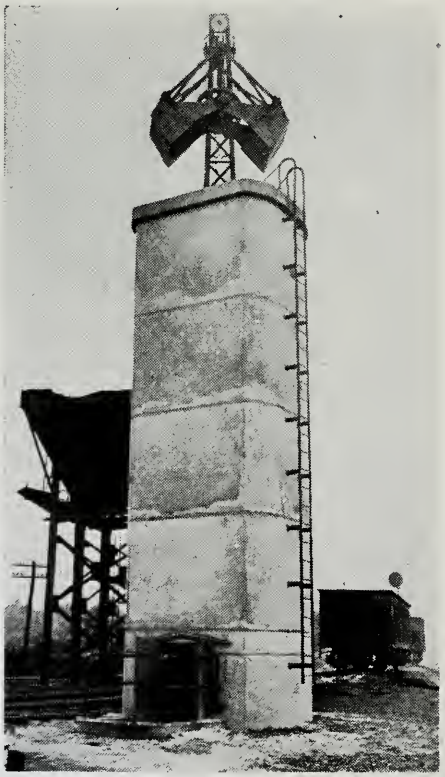

Precast sections of 97" x 97" Flat Base Pipe made possible the construction of this sanding tower in record time with a minimum of labor and equipment.

Let Massey Engineers help with your problems.

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MUCH of the amazing wartime effectiveness of America's rail transportation system can be attributed to a far-sighted engineering program on the part of management that prepared the railroads for today's emergency.

It has been our privilege to participate in this strategic program as the "construction partner" of many railroads. Our activities have included a wide variety of structures—buildings, turntables, subways, viaducts and modern bridges.

We are glad to have had a part in projects which contribute so greatly to the wartime usefulness of the railroads. And we look forward to the time of peace when all our resources will again stand ready to serve the railroads in meeting their post-war tasks and responsibilities.

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General Offices: Frick Building, Pittsburgh, Pa.

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PRESSURE-TREATED TIMBER

Railway bridge and building engineers are benefiting greatly by the use of Pressure-Treated Timber in scores of diversified applications.

Pressure-Treated Timber resists decay—termite attack—marine borers—fire. It is economical and easy to install. It does not spall or corrode.

We will gladly show you where you can apply Pressure-Treated Timber to advantage in your building and repair program.

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use KOPPERS products

● NO-OX-ID protective coating can be brushed on over rust without expensive pre-cleaning. It applies readily, and therefore large areas can be covered in little time. This enables you to maintain your bridges with fewer men and at lower cost.

All you need to do is to scrape off the loose rust patches and then apply a single coat of NO-OX-ID over the remaining rust and old paint. NO-OX-ID will penetrate to the metal and stop further corrosion.

NO-OX-ID acts in two ways: mechanically, to exclude moisture and oxygen from the surface and chemically to inhibit corrosion under the film. It offers the most economical method of bridge maintenance. Write for further information.

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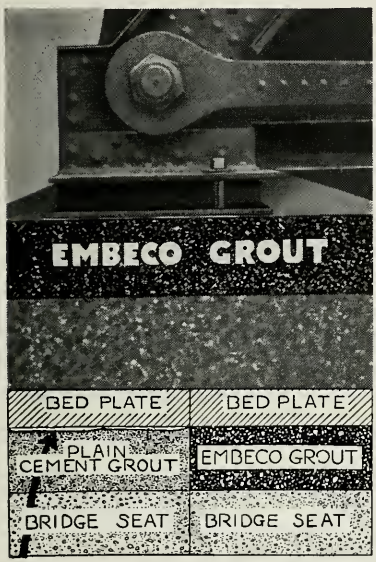
Non-Shrink Embeco has no equal for *Speed* and *Permanence* in such operations as . . .



Shrinkage has been the major cause of ordinary grout failure. Poor contact between the grout and bedplate permits increased vibration resulting in more rapid wear and disintegration. Embeco Non-Shrink grout creates an ideal bearing surface that stands up for years.

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The Non-Shrinking and Quick-Setting properties of Embeco saves many MAN-HOURS.

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Write for Pictorial Specifications — available to all Railroad Engineering and Maintenance Men.

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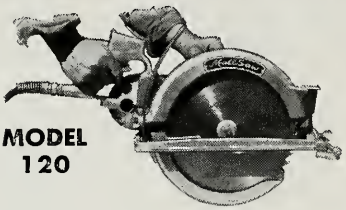
EASE the Labor Shortage with Mall REG. U.S. PAT. OFF. PORTABLE POWER TOOLS



MODEL 120

MALL SAW

12" Blade — 4½" Cutting Capacity
Also Pneumatic Models

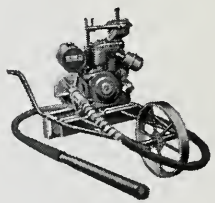
For extensive sawing and ripping heavy lumber and timbers. Also operates an abrasive wheel for sawing non-ferrous metal up to ½" in thickness, cutting and scoring tile, stone and concrete.

Mall CHAIN SAW

5 H.P. GASOLINE ENGINE MODEL
36" Capacity
Also Available in 24" and 48" sizes
Also Pneumatic Models

Cuts heavy timber and piling in a fraction of the time required by hand. Automatic clutch prevents stalling the engine when saw is forced or pinched too hard. Swivel feature permits cuts at necessary angles. Easily and quickly sharpened on the job.

3 H.P.



Mall CONCRETE VIBRATORS

Gasoline Engine Model

Place low water-cement ratio concrete quickly and efficiently, assuring a strong, water-tight job free from honeycombs and voids that require hand patching. Variable speed engine operates eight other tools. Can be furnished with round base or wheelbarrow type mounting, 1½ H.P. gasoline engine unit, and pneumatic models.

Write for literature and prices to Railroad Department; also inquire about MALL Rail Grinders.

MALL TOOL COMPANY

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"ROADMASTER"

MODEL F2B

Designed to carry a two to four man crew, the "Roadmaster" is ideal for small bridge or maintenance crews. See the outstanding "Roadmaster" features which make this car the "tops" in safety, performance and comfort.

SAFER **—all controls in reach . . . 4-wheel brakes . . . safety rail skids.**

POWERFUL **—husky air-cooled engine . . . reversible transmission and positive chain drive.**

ROOMIER **—ample for 4 persons . . . lots of deck and equipment space . . . plenty of leg room.**

Get a SAFER, BETTER ride with Buda!

"KLINCH-KLAW" BRIDGE JACK

The "Klinch-Klaw" Bridge Jack is a ratchet trip type jack designed for pulling bolts, spikes, rods, etc., from any position, on trestle or bridge jobs. Check these exclusive advantages.

- **Pulls all types of bolts, spikes, headless bolts . . . anywhere.**
- **Pulls bolts from between . . . or 20" below ties.**
- **Pulls chord bolts and spikes from side beams . . . safely.**
- **Can be used as general utility lifting jack.**

The only jack of its type on the market today! Buda bulletin No. 957-B completely describes this unusual jack.

WRITE OR WIRE INFORMATION ABOUT THE COMPLETE BUDA LINE OF RAILWAY EQUIPMENT AND SUPPLIES

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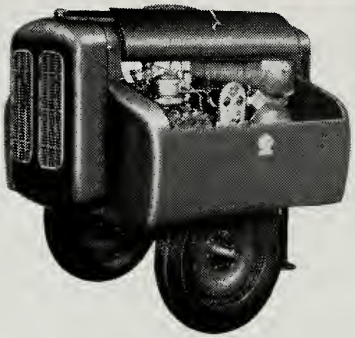
HARVEY (Chicago Suburb) ILLINOIS

SCHRAMM

AIR COMPRESSORS FOR RAILWAY MAINTENANCE

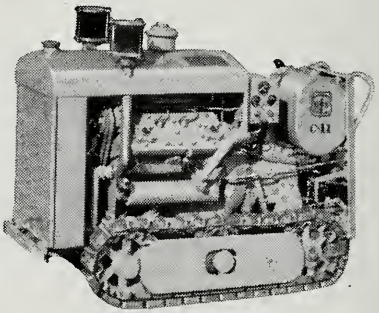


#60 DELUXE WITH TOOL BOXES

The #60 DeLuxe Model is equipped with streamlined tool boxes and universal trailer coupling or towing ring for connection behind truck or car or any other mobile unit.

Schramm Compressors are built in sizes ranging from 20-420 cu. ft. of actual air delivery. In various types of mountings and both gasoline or diesel engine driven.

A complete self-contained automatic compressor with mechanical drive, three speeds forward and one reverse. An excellent unit for off-track and general maintenance work.



#60 CRAWLER TYPE

SCHRAMM INC. THE COMPRESSOR PEOPLE WEST CHESTER PENNSYLVANIA

Bitumastic Super-Service Black protects I Beams supporting tracks across this cinder pit from acid water — and also the crane structure and wire pit screens.

FOR CORROSION "HOT SPOTS"

Do you have trouble in preventing corrosion on bridges, cinder pits, tanks, round houses and other surfaces which are exposed to fumes, acid water, and extreme moisture conditions?

Bitumastic Blacks are designed to protect just such surfaces. They are chemically inert and have a useful life many times that of asphalt or oil base products.

Bitumastic Coatings have been used for over 90 years in fighting the most severe corrosive forces, including those which exist under ground and under water.

These coatings are sold by Wailes Dove-Hermiston and through distribution in principal cities.

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"OVERHEAD DOORS"

★ **The ideal door for every use is The "OVERHEAD DOOR", built in any size to fit any opening. Our trade mark means quality wherever found . . . long service, easy operation, Salt Spray Steel tracks and hardware and the weather-tight Miracle Wedge closure.**

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"OVERHEAD DOOR"
TRADE MARK
WITH THE
MIRACLE WEDGE

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Buy **WAR BONDS** *and* **STAMPS**

Top: The "OVERHEAD DOOR" with built-in pass door, in an engine repair shed.

Right: Large, electrically operated "OVERHEAD DOORS" in a freight terminal.

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TECO CONNECTORS

**for increased strength and rigidity . . . . .
lower maintenance costs.**

Types of railway timber structures using TECO connectors:

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2. Overhead Cranes
3. Timber Bents
4. Connections Between Pile Heads and Caps
5. Trestles
6. Ballast Deck Stub Piles
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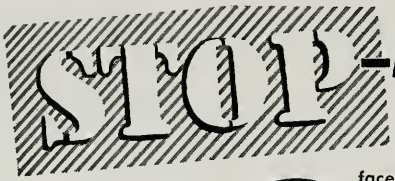
8. Pier Fenders
9. Sway Bracing
10. Coal Pockets
11. Auto Loading Dock
12. Between Rail Posts and Tie Connections
13. Bridge Decks
14. Scaffolding
15. Cooling Towers

Over 70 railroads have found TECO connectors make railway timbers do more work. Write for *free* literature.

**TECO
TIMBER CONNECTORS
Stronger Joints
Less Material**

TIMBER ENGINEERING COMPANY

Washington, D. C. San Francisco, California



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The finest paint won't last long when applied to rusty, scaly steel. Little wonder that so many railroad men prepare metal surfaces by Airco Flame Cleaning before they paint. This flexible process removes rust and scale. It dehydrates as it cleans, leaving a warm, dry surface conducive to a long-lasting paint job. Write for full details.

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Wolmanized VACUUM-PRESSURE TREATED **LUMBER**

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IT has been estimated that 60,000 locomotives would be required to handle the volume of traffic now being handled by 39,000 if it were not for modern water treatment, much of which is being supplied by Nalco.

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According to one authority 0.1 inch of scale in a boiler will cause heat losses as high as 15%. More than 4000 power plants using the Nalco System are eliminating such losses.

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Floating boilers can't take time out. A Nalco conditioned steamship recently set an all-time mileage record on the Great Lakes for one season.

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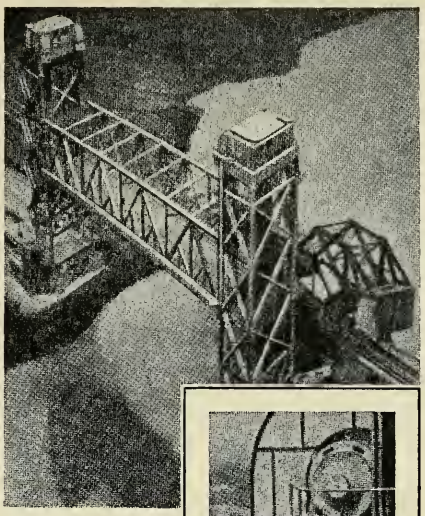
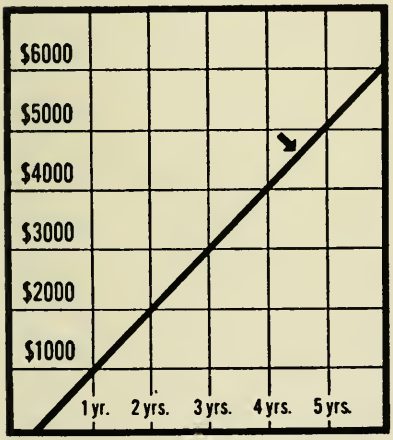
DESIGN FOR OPERATING ECONOMY

IN YOUR POST-WAR PLANNING ON VERTICAL-LIFT AND BASCULE BRIDGES



Chicago's Torrence Avenue Bridge and one of the 8 Bantam Bearing equipped million pound capacity sheaves on which it lifts.



Maximum economy of operation in movable bridges must be "engineered" into designs in the planning state. Many successful bridge designers have found the experience of our engineering staff helpful.

The result may be seen in the accompanying graph, which shows the actual power savings in one typical case. $4500 saved in power alone in 4½ years. In addition, there were big savings due to lowered lubrication costs and a considerable reduction in the size of operating motors and mechinery.

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